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PROPOSAL FOR DRAFT AMENDMENTS TO REGULATION No. 110
(Specific components for CNG)

Transmitted by the expert from the
European Natural Gas Vehicle Association (ENGVA)

Note: The document reproduced below was prepared by the expert from ENGVA in order to introduce in the Regulation provisions for the testing of flexible hoses made of plastic.

Note: This document is distributed to the Experts on Pollution and Energy only.

A. PROPOSAL

Annex 4B.

Paragraph 1.3.1., amend to read:

"1.3.1. Tensile strength and elongation for rubber material and for thermoplastic elastomers (TPE)"

Paragraph 1.3.1.3., amend to read:

"1.3.1.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 1.3.1.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Insert new paragraphs 1.3.2. to 1.3.2.3., to read:

"1.3.2. Tensile strength and elongation specific for thermoplastic material.

1.3.2.1. Tensile strength and elongation at break according to ISO 527-2 with the following conditions:

- (i) specimen type: type 1 BA.
- (ii) tensile speed: 20 mm/min.

The material has to be conditioned for at least 21 days at 23 °C and 50 per cent relative humidity prior to testing.

Requirements:

- (i) tensile strength not less than 20 MPa.
- (ii) elongation at break not less than 100 per cent.

1.3.2.2. Resistance to n-pentane according to ISO 1817 with the following conditions:

- (i) medium: n-pentane.
- (ii) temperature: 23 °C (tolerance according to ISO 1817).
- (iii) immersion period: 72 hours.

Requirements:

- (i) maximum change in volume 2 per cent.
- (ii) maximum change in tensile strength 10 per cent.
- (iii) maximum change in elongation at break 10 per cent.

After storage in air with a temperature of 40 °C for a period of 48 hours the mass compared to the original value may not decrease more than 5 per cent.

1.3.2.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 1.3.2.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Paragraph 1.4.1., amend to read:

"1.4.1. Tensile strength and elongation for rubber material and for thermoplastic elastomers (TPE)"

Paragraph 1.4.1.3., amend to read:

"1.4.1.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 1.4.1.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Insert new paragraphs 1.4.2. to 1.4.2.3., to read:

"1.4.2. Tensile strength and elongation specific for thermoplastic material.

1.4.2.1. Tensile strength and elongation at break according to ISO 527-2 with the following conditions:

- (i) specimen type: type 1 BA.
- (ii) tensile speed: 20 mm/min.

The material has to be conditioned for at least 21 days at 23 °C and 50 per cent relative humidity prior to testing.

Requirements:

- (i) tensile strength not less than 20 MPa.
- (ii) elongation at break not less than 100 per cent.

1.4.2.2. Resistance to n-hexane according to ISO 1817 with the following conditions:

- (i) medium: n-hexane.
- (ii) temperature: 23 °C (tolerance according to ISO 1817).
- (iii) immersion period: 72 hours.

Requirements:

- (i) maximum change in volume 2 per cent.
- (ii) maximum change in tensile strength 10 per cent.
- (iii) maximum change in elongation at break 10 per cent.

After storage in air with a temperature of 40 °C for a period of 48 hours the mass compared to the original value may not decrease more than 5 per cent.

1.4.2.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 1.4.2.1.

Requirements:

- (i) maximum change in tensile strength 20 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 50 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Paragraphs 1.4.2. to 1.4.2.2. (former), should be renumbered as paragraphs 1.4.3. to 1.4.3.2.

Paragraph 1.5.3.1., amend to read:

"1.5.3.1. ... the test-pressure as mentioned in paragraph 1.5.4.2. The test shall be performed on both new hose and after ageing according to ISO 188 as prescribed in paragraph 1.4.2.3. and subsequently to ISO 1817 as prescribed in paragraph 1.4.2.2."

Paragraph 2.3.1., amend to read:

"2.3.1. Tensile strength and elongation for rubber material and for thermoplastic elastomers (TPE)"

Paragraph 2.3.1.3., amend to read:

"2.3.1.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 2.3.1.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Insert new paragraphs 2.3.2. to 2.3.2.3., to read:

"2.3.2. Tensile strength and elongation specific for thermoplastic material.

2.3.2.1. Tensile strength and elongation at break according to ISO 527-2 with the following conditions:

- (i) specimen type: type 1 BA.
- (ii) tensile speed: 20 mm/min.

The material has to be conditioned for at least 21 days at 23 °C and 50 per cent relative humidity prior to testing.

Requirement:

- (i) tensile strength not less than 20 MPa.
- (ii) elongation at break not less than 100 per cent.

2.3.2.2. Resistance to n-pentane according to ISO 1817 with the following conditions:

- (i) medium: n-pentane.
- (ii) temperature: 23 °C (tolerance according to ISO 1817).
- (iii) immersion period: 72 hours.

Requirements:

- (i) maximum change in volume 2 per cent.
- (ii) maximum change in tensile strength 10 per cent.
- (iii) maximum change in elongation at break 10 per cent.

After storage in air with a temperature of 40 °C for a period of 48 hours the mass compared to the original value may not decrease more than 5 per cent.

2.3.2.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 2.3.2.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Paragraph 2.4.1., amend to read:

"2.4.1. Tensile strength and elongation for rubber material and for thermoplastic elastomers (TPE)"

Paragraph 2.4.1.3., amend to read:

"2.4.1.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10 °C)
- (ii) exposure period: 24 and 336 hours

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 2.4.1.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Insert new paragraphs 2.4.2. to 2.4.2.3., to read:

"2.4.2. Tensile strength and elongation specific for thermoplastic material.

2.4.2.1. Tensile strength and elongation at break according to ISO 527-2 with the following conditions:

- (i) specimen type: type 1 BA.
- (ii) tensile speed: 20 mm/min.

The material has to be conditioned for at least 21 days at 23 °C and 50 per cent relative humidity prior to testing.

Requirements:

- (i) tensile strength not less than 20 MPa.
- (ii) elongation at break not less than 100 per cent.

2.4.2.2. Resistance to n-hexane according to ISO 1817 with the following conditions:

- (i) medium: n-hexane.
- (ii) temperature: 23 °C (tolerance according to ISO 1817).
- (iii) immersion period: 72 hours.

Requirements:

- (i) maximum change in volume 2 per cent.
- (ii) maximum change in tensile strength 10 per cent.
- (iii) maximum change in elongation at break 10 per cent.

After storage in air with a temperature of 40 °C for a period of 48 hours the mass compared to the original value may not decrease more than 5 per cent.

2.4.2.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 2.4.2.1.

Requirements:

- (i) maximum change in tensile strength 20 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 50 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Paragraphs 2.4.2. to 2.4.2.3. (former), should be renumbered as paragraphs 2.4.3. to 2.4.3.3.

Paragraph 2.5.3.1., amend to read:

"2.5.3.1. ... the test-pressure as mentioned in paragraph 2.5.4.2. The test shall be performed on both new hose and after ageing according to ISO 188 as prescribed in paragraph 2.4.2.3. and subsequently to ISO 1817 as prescribed in paragraph 2.4.2.2."

Paragraph 3.3.1., amend to read:

"3.3.1. Tensile strength and elongation for rubber material and for thermoplastic elastomers (TPE)"

Paragraph 3.3.1.3., amend to read:

"3.3.1.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 3.3.1.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Insert new paragraphs 3.3.2. to 3.3.2.3., to read:

"3.3.2. Tensile strength and elongation specific for thermoplastic material.

3.3.2.1. Tensile strength and elongation at break according to ISO 527-2 with the following conditions:

- (i) specimen type: type 1 BA.
- (ii) tensile speed: 20 mm/min.

The material has to be conditioned for at least 21 days at 23 °C and 50 per cent relative humidity prior to testing.

Requirement:

- (i) tensile strength not less than 20 MPa.
- (ii) elongation at break not less than 100 per cent.

3.3.2.2. Resistance to n-pentane according to ISO 1817 with the following conditions:

- (i) medium: n-pentane.
- (ii) temperature: 23 °C (tolerance according to ISO 1817).
- (iii) immersion period: 72 hours.

Requirements:

- (i) maximum change in volume 2 per cent.
- (ii) maximum change in tensile strength 10 per cent.
- (iii) maximum change in elongation at break 10 per cent.

After storage in air with a temperature of 40 °C for a period of 48 hours the mass compared to the original value may not decrease more than 5 per cent.

3.3.2.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 3.3.2.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Paragraph 3.4.1., amend to read:

"3.4.1. Tensile strength and elongation for rubber material and for thermoplastic elastomers (TPE)"

Paragraph 3.4.1.3., amend to read:

"3.4.1.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 3.4.1.1.

Requirements:

- (i) maximum change in tensile strength 35 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 25 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Insert new paragraphs 3.4.2. to 3.4.2.3., to read:

"3.4.2. Tensile strength and elongation specific for thermoplastic material.

3.4.2.1. Tensile strength and elongation at break according to ISO 527-2 with the following conditions:

- (i) specimen type: type 1 BA.
- (ii) tensile speed: 20 mm/min.

The material has to be conditioned for at least 21 days at 23 °C and 50 per cent relative humidity prior to testing.

Requirements:

- (i) tensile strength not less than 20 MPa.
- (ii) elongation at break not less than 100 per cent.

3.4.2.2. Resistance to n-hexane according to ISO 1817 with the following conditions:

- (i) medium: n-hexane.
- (ii) temperature: 23 °C (tolerance according to ISO 1817).
- (iii) immersion period: 72 hours.

Requirements:

- (i) maximum change in volume 2 per cent.
- (ii) maximum change in tensile strength 10 per cent.
- (iii) maximum change in elongation at break 10 per cent.

After storage in air with a temperature of 40 °C for a period of 48 hours the mass compared to the original value may not decrease more than 5 per cent.

3.4.2.3. Resistance to ageing according to ISO 188 with the following conditions:

- (i) temperature: 115 °C (test temperature = maximum operating temperature minus 10°C).
- (ii) exposure period: 24 and 336 hours.

After ageing the specimens have to be conditioned at 23 °C and 50 per cent relative humidity for at least 21 days prior to carrying out the tensile test according to paragraph 3.4.2.1.

Requirements:

- (i) maximum change in tensile strength 20 per cent after 336 hours ageing compared to the tensile strength of the 24 hours aged material.
- (ii) maximum change in elongation at break 50 per cent after 336 hours ageing compared to the elongation at break of the 24 hours aged material."

Paragraphs 3.4.2. to 3.4.2.3. (former), should be renumbered as paragraphs 3.4.3. to 3.4.3.3.

Paragraph 3.5.3.1., amend to read:

"3.5.3.1. ... in an oven at a temperature of 120 °C ± 2 °C during 24 hours. The test shall be performed on both new hose and after ageing according to ISO 188 as prescribed in paragraph 3.4.2.3. and subsequently to ISO 1817 as prescribed in paragraph 3.4.2.2."

B. JUSTIFICATION

The amendment proposed to Annex 4B of Regulation No. 110 introduces provisions for the homologation test of flexible hoses made of plastic. In the Regulation No. 110 now are considered only flexible hoses made of rubber. The elongation at break has to be modified. The test methods are similar to those included in Regulation No. 67-01 (specific components for LPG).
