



GRAND-DUCHÉ DE LUXEMBOURG

Ministère du Développement durable  
et des Infrastructures  
Département des Transports

L-2938 Luxembourg

SOCIÉTÉ NATIONALE DE  
CERTIFICATION ET D'HOMOLOGATION  
s.à r.l.

Registre de Commerce: B 27180

L-5201 Sandweiler



Référence: E13\*110R00\*110R01\*0344\*00

Annexes: - Rapport technique  
- Fiche de renseignements du constructeur

Sandweiler, le 02 mai 2016



**Communication concernant: - Délivrance d'homologation**

Communication concerning:

Approval granted

~~- Extension d'homologation~~

~~Approval extended~~

~~- Refus d'homologation~~

~~Approval refused~~

~~- Retrait d'homologation~~

~~Approval withdrawn~~

~~- Arrêt définitif de la production~~

~~Production definitively discontinued~~

**d'un type d'organe GNC/GNL en application du Règlement N° 110**  
of a type of CNG/LNG component pursuant to Regulation N° 110

**Homologation N°:**

Approval number:

E13\*110R00\*110R01\*0344\*00

**Marque d'homologation:**

Approval mark:



110R-010344 "C"

1.

**Organe GNC/GNL <sup>(2)</sup>:**

CNG/LNG component considered <sup>(2)</sup>:

**Réservoir(s) ou bouteille(s):**

Container(s) or cylinder(s):

not applicable

**Réservoir(s) ou récipient(s):**

Tank(s) or vessel(s):

not applicable

**Témoin de pression:**

Pressure indicator:

not applicable

**Soupape de surpression:**

Pressure relief valve:

not applicable

<b>Vanne(s) automatique(s):</b> Automatic valve(s):	not applicable
<b>Limiteur de débit:</b> Excess flow valve:	not applicable
<b>Capot étanche:</b> Gas-tight housing:	not applicable
<b>Détendeur(s):</b> Pressure regulator(s):	not applicable
<b>Clapet(s) antiretour:</b> Non-return valve(s) or check valve(s):	applicable
<b>Dispositif de surpression (à déclenchement thermique):</b> Pressure relief device (PRD) (temperature triggered):	not applicable
<b>Vanne manuelle:</b> Manual valve:	not applicable
<b>Flexibles:</b> Flexible fuel lines:	not applicable
<b>Embout ou réceptacle de remplissage:</b> Filling unit or receptacle:	not applicable
<b>Injecteur(s) de gaz:</b> Gas injector(s):	not applicable
<b>Régulateur de débit de gaz:</b> Gas flow adjuster:	not applicable
<b>Mélangeur gaz / air:</b> Gas / air mixer:	not applicable
<b>Module électronique de commande:</b> Electronic control unit:	not applicable
<b>Capteur(s) de pression et de température:</b> Pressure and temperature sensor(s):	not applicable
<b>Filtre(s) à GNC:</b> CNG filter(s):	not applicable
<b>Dispositif de surpression (à déclenchement manométrique):</b> Pressure relief device (PRD) (pressure triggered):	not applicable
<b>Rampe d'alimentation:</b> Fuel rail:	not applicable
<b>Echangeur(s) thermique(s) / vaporisateur(s):</b> Heat exchanger(s) / vaporizer(s):	not applicable
<b>Détecteur(s) de gaz naturel:</b> Natural gas detector(s):	not applicable
<b>Réceptacle(s) de remplissage GNL:</b> LNG filling receptacle(s):	not applicable

	<b>Détendeur(s) GNL:</b> LNG pressure control regulator(s):	not applicable
	<b>Capteur(s) de pression et/ou de température GNL:</b> LNG pressure and/or temperature sensor(s):	not applicable
	<b>Vanne(s) manuelle(s) GNL:</b> LNG manual valve(s):	not applicable
	<b>Vanne(s) automatique(s) GNL:</b> LNG automatic valve(s):	not applicable
	<b>Clapet(s) antiretour GNL:</b> LNG non-return valve(s):	not applicable
	<b>Soupape(s) de surpression GNL:</b> LNG pressure relief valve(s):	not applicable
	<b>Limiteur(s) de débit GNL:</b> LNG excess flow valve(s):	not applicable
	<b>Pompe(s) à GNL:</b> LNG fuel pump(s):	not applicable
2.	<b>Marque de fabrique ou de commerce:</b> Trade name or mark:	HSME
3.	<b>Nom et adresse du constructeur:</b> Manufacturer's name and address:	HSME Corporation 8, Hwajeonsandan 5-Ro, Gangseo-gu 618-280 Busan Korea
4.	<b>S'il y a lieu, nom et adresse du représentant du constructeur:</b> If applicable, name and address of manufacturer's representative:	not applicable
5.	<b>Présenté à l'homologation le:</b> Submitted for approval on:	25.08.2015 – 21.04.2016
6.	<b>Autorité déléguée:</b> <i>Assigned authority:</i>	<i>Société Nationale de Certification et d'Homologation L-5201 Sandweiler</i>
	<b>Service technique chargé des essais d'homologation:</b> Technical Service responsible for conducting approval tests:	TÜV Rheinland Luxemburg GmbH 2a, Kalchesbruck L-1852 Luxembourg
7.	<b>Date du procès-verbal délivré par ce service:</b> Date of report issued by that Service:	21.04.2016
8.	<b>Numéro du procès-verbal:</b> Number of report issued by that Service:	TS-110R-004/16
9.	<b>L'homologation est <sup>(2)</sup>:</b> Approval <sup>(2)</sup> :	granted / <del>refused</del> / <del>extended</del> / <del>withdrawn</del>
10.	<b>Raison(s) de l'extension (s'il y a lieu):</b> Reason(s) of extension (if applicable):	not applicable

E13\*110R00\*110R01\*0344\*00

11. **Lieu:**  
Place: Sandweiler
12. **Date:**  
Date: 02 mai 2016
13. **Signature:**  
Signature:

Pour le Département des Transports



**Marco FELTES**  
Inspecteur Principal 1<sup>er</sup> en rang

Pour la SNCH



**Claude LIESCH**  
Directeur



14. **Les documents soumis dans le dossier d'homologation ou d'extension d'homologation peuvent être obtenues sur demande:**  
The documents filed with the application or extension of approval can be obtained upon request:

see: INDEX to TYPE-APPROVAL REPORT

**ADDITIF**  
**ADDENDUM**

- 1. Renseignements complémentaires concernant l'homologation d'un type d'organe GNC/GNL en application du Règlement N° 110 <sup>(1)</sup>:**  
Additional information concerning the type-approval of a type of CNG/LNG components pursuant to Regulation N° 110 <sup>(1)</sup>:
- 1.1. Système de stockage du gaz naturel**  
Natural Gas Storage System
- 1.1.1. Réservoir(s) ou bouteille(s) (système GNC):**  
Container(s) or cylinder(s) (for CNG system): not applicable
- 1.1.1.1. Dimensions:**  
Dimensions: not applicable
- 1.1.1.2. Matériau:**  
Material: not applicable
- 1.1.2. Réservoir(s) ou récipient(s) (système GNL):**  
Tank(s) or vessel(s) (for LNG system): not applicable
- 1.1.2.1. Capacité:**  
Capacity: not applicable
- 1.1.2.2. Matériau:**  
Material: not applicable
- 1.2. Témoin de pression:**  
Pressure indicator: not applicable
- 1.2.1. Pression(s) maximale(s) de fonctionnement:**  
Working pressure(s): not applicable
- 1.2.2. Matériau:**  
Material: not applicable
- 1.3. Soupape de surpression (soupape de décompression):**  
Pressure relief valve (discharge valve): not applicable
- 1.3.1. Pression(s) maximale(s) de fonctionnement:**  
Working pressure(s): not applicable
- 1.3.2. Matériau:**  
Material: not applicable
- 1.4. Vanne(s) automatique(s):**  
Automatic valve(s): not applicable
- 1.4.1. Pression(s) maximale(s) de fonctionnement:**  
Working pressure(s): not applicable
- 1.4.2. Matériau:**  
Material: not applicable
- 1.5. Limiteur de débit:**  
Excess flow valve: not applicable
- 1.5.1. Pression(s) maximale(s) de fonctionnement:**  
Working pressure(s): not applicable
- 1.5.2. Matériau:**  
Material: not applicable
- 1.6. Capot étanche:**  
Gas-tight housing: not applicable
- 1.6.1. Pression(s) maximale(s) de fonctionnement:**  
Working pressure(s): not applicable
- 1.6.2. Matériau:**  
Material: not applicable
- 1.7. Détendeur(s):**  
Pressure regulator(s): not applicable
- 1.7.1. Pression(s) maximale(s) de fonctionnement:**  
Working pressure(s): not applicable
- 1.7.2. Matériau:**  
Material: not applicable

<b>1.8.</b>	<b>Clapet(s) antiretour:</b> Non-return valve(s) or check valve(s):	Type: <b>VCHC6 series</b> Variants: VCHC6A VCHC6B
<b>1.8.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	26,0 MPa
<b>1.8.2.</b>	<b>Matériau:</b> Material:	see information folder
<b>1.9.</b>	<b>Dispositif de surpression (à déclenchement thermique):</b> Pressure relief device (temperature triggered):	not applicable
<b>1.9.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.9.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.10.</b>	<b>Vanne manuelle:</b> Manual valve:	not applicable
<b>1.10.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.10.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.11.</b>	<b>Flexibles:</b> Flexible fuel lines:	not applicable
<b>1.11.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.11.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.12.</b>	<b>Embout ou réceptacle de remplissage:</b> Filling unit or receptacle:	not applicable
<b>1.12.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.12.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.13.</b>	<b>Injecteur(s):</b> Gas injector(s):	not applicable
<b>1.13.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.13.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.14.</b>	<b>Régulateur de débit:</b> Gas flow adjuster:	not applicable
<b>1.14.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.14.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.15.</b>	<b>Mélangeur gaz / air:</b> Gas / air mixer:	not applicable
<b>1.15.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.15.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.16.</b>	<b>Module électronique de commande:</b> Electronic control unit:	not applicable
<b>1.16.1.</b>	<b>Principes de base du logiciel:</b> Basic software principles:	not applicable
<b>1.17.</b>	<b>Capteur(s) de pression et de température:</b> Pressure and temperature sensor(s):	not applicable
<b>1.17.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.17.2.</b>	<b>Matériau:</b> Material:	not applicable

1.18.	<b>Filtre(s) à GNC:</b> CNG filter(s):	not applicable
1.18.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.18.2.	<b>Matériau:</b> Material:	not applicable
1.19.	<b>Dispositif de surpression (à déclenchement manométrique):</b> Pressure relief device (pressure triggered):	not applicable
1.19.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.19.2.	<b>Matériau:</b> Material:	not applicable
1.20.	<b>Rampe(s) d'alimentation:</b> Fuel rail(s):	not applicable
1.20.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.20.2.	<b>Matériau:</b> Material:	not applicable
1.21.	<b>Echangeur(s) thermique(s) / vaporisateur(s):</b> Heat exchanger(s) / vaporizer(s):	not applicable
1.21.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.21.2.	<b>Matériau:</b> Material:	not applicable
1.22.	<b>Détecteur(s) de gaz naturel:</b> Natural gas detector(s):	not applicable
1.22.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.22.2.	<b>Matériau:</b> Material:	not applicable
1.23.	<b>Réceptacle(s) de remplissage GNL:</b> LNG filling receptacle(s):	not applicable
1.23.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.23.2.	<b>Matériau:</b> Material:	not applicable
1.24.	<b>Détendeur(s) GNL:</b> LNG pressure control regulator(s):	not applicable
1.24.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.24.2.	<b>Matériau:</b> Material:	not applicable
1.25.	<b>Capteur(s) de pression et/ou de température GNL:</b> LNG pressure and/or temperature sensor(s):	not applicable
1.25.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.25.2.	<b>Matériau:</b> Material:	not applicable
1.26.	<b>Vanne(s) manuelle(s) GNL:</b> LNG manual valve(s):	not applicable
1.26.1.	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
1.26.2.	<b>Matériau:</b> Material:	not applicable

<b>1.27.</b>	<b>Vanne(s) automatique(s) GNL:</b> LNG automatic valve(s):	not applicable
<b>1.27.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.27.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.28.</b>	<b>Clapet(s) antiretour GNL:</b> LNG non-return valve(s):	not applicable
<b>1.28.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.28.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.29.</b>	<b>Soupape(s) de surpression GNL:</b> LNG pressure relief valve:	not applicable
<b>1.29.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.29.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.30.</b>	<b>Limiteur de débit GNL:</b> LNG excess flow valve:	not applicable
<b>1.30.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.30.2.</b>	<b>Matériau:</b> Material:	not applicable
<b>1.31.</b>	<b>Pompe(s) à GNL:</b> LNG fuel pump(s):	not applicable
<b>1.31.1.</b>	<b>Pression(s) maximale(s) de fonctionnement:</b> Working pressure(s):	not applicable
<b>1.31.2.</b>	<b>Matériau:</b> Material:	not applicable

<sup>(1)</sup> **Indiquer la tolérance.**  
Specify the tolerance.

<sup>(2)</sup> **Biffer les mentions inutiles.**  
Strike out what does not apply.





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L-5201 Sandweiler



Référence: E13\*110R00\*110R01\*0344\*00

Annexes: - Rapport technique  
- Fiche de renseignements du constructeur

Sandweiler, le 02 mai 2016

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	<b>Numéro d'homologation:</b> Approval number:	E13*110R00*110R01*0344*00
	<b>Révision:</b> Revision:	00
	<b>Marque de fabrique ou de commerce:</b> Trade name or mark:	HSME
	<b>Type:</b> Type:	VCHC6 series
1.	<b>Procès-verbal d'essai:</b> Test report:	N° TS-110R-004/16
	- Technical report:	Page(s) 1 to 10;
	- List of modifications:	Appendix 0 - Page(s) 11;
	- Essential characteristics of the CNG-component:	Appendix 1 - Page(s) 1.
2.	<b>Dossier du constructeur:</b> Report of the manufacturer:	Appendix 2
	- Manufacturer's information document:	2 page(s).
3.	<b>Autres documents annexés:</b> Other documents annexed:	not applicable
4.	<b>Date de délivrance de l'homologation initiale:</b> Date of issue of initial type approval:	02.05.2016
5.	<b>Date de la dernière délivrance de pages révisées:</b> Date of last issue of revised pages:	not applicable
6.	<b>Date de la dernière délivrance d'une homologation révisée:</b> Date of last extension:	not applicable

Technical Report No. TS-110R-004/16  
Applicant: HSME Corporation  
Type: VCHC6 series



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**TECHNICAL REPORT**  
**No. TS-110R-004/16**

**CONCERNING THE APPROVAL OF SPECIFIC COMPONENTS OF MOTOR VEHICLES USING  
COMPRESSED NATURAL GAS (CNG) AND/OR LIQUEFIED NATURAL GAS (LNG) IN THEIR  
PROPULSION SYSTEM ACCORDING TO THE  
ECE-R 110-01**

**Manufacturer/Applicant:** HSME Corporation  
8, Hwajeonsandan 5-Ro, Gangseo-gu  
618-280 Busan  
Korea

**Trade name or mark:** HSME

**Type:** VCHC6 series

**Variants:** VCHC6A  
VCHC6B

**Specific component:** check valve/non-return valve

**Approval number:** E13\*110R00\*110R01\*xxxx\*00

**Applicable regulation(s):** ECE R110, revision 1, incl. supplement 3 of 2015-10-08

**Class:** 0

**Subject of the extension:** n/a

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Technical Report No. TS-110R-004/16  
Applicant: HSME Corporation  
Type: VCHC6 series

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Technical Report No. TS-110R-004/16  
Applicant: HSME Corporation  
Type: VCHC6 series

## Appendices

Appendix no.	according to ECE R110	Description
0	--	List of modifications
1	Annex 1A	Essential Characteristics of the CNG component
2	Part 1, 5.2.3	Drawings of VCHC6A and VCHC6B

Technical Report No. TS-110R-004/16  
Applicant: HSME Corporation  
Type: VCHC6 series

## 1. Subject

With its request of 2016-04-04, the company HSME Corporation, Korea, applies for the approval of the specific component “check valve/non-return valve”, type VCHC6 series, according to the ECE Regulation No. 110.

The responsible Technical Service is the TÜV Rheinland Luxemburg GmbH.

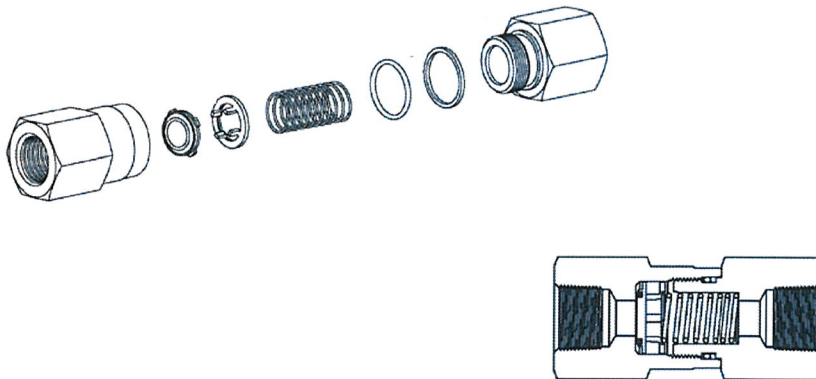
## 2. Technical Data

### 2.1 Intended Use

The check valve/non-return valve is an automatic valve that allows the natural gas to flow in one direction only.

Technical Data:		
Service pressure:		20.0 MPa
working pressure:		26.0 MPa
Operating temperatures [°C]:		-20°C ↔ +120°C
Class:		0
Materials:	body:	SS316
	sealing:	PTFE, HNBR

### 2.2 Design and Manufacture



The materials to be used including material data and the manufacturing/production parameters are specified in the manufacturer’s documentation and, if adequate, the technical drawings respectively.

### 3. Tests

Subsequent to a detailed design verification the following test plan based on Annex 4A and Annex 5, table 5.1, of ECE-R110 was defined and the tests performed.

No.	Description	Annex ECE R110	Sample No.	Remark
1	Overpressure or strength	5A	1	successful
2	External Leakage	5B	1-6	successful
3	Internal leakage	5C	1-6	successful
4	Durability test - Check valve	5L / 4A art. 3.2.3	6	successful
5	CNG compatibility	5D	several undefined	successful
6	Corrosion resistance	5E	2	successful
7	Resistance to dry heat	5F	several undefined	successful
8	Ozone ageing	5G	several undefined	successful
9	Temperature cycle	5H	3	successful
10	Vibration resistance	5N	2	successful
11	Operating temperatures	5O	1-6	successful
12	Provisions regarding the approval of the non-return valve	4A, art.3	1-6	successful

- 3.1 Equipment for measuring and testing:** The test facilities / measurement equipment used were in compliance with the test requirements
- 3.2 Attributive tests:** The component is marked durably by engraving or stamping.  
 Additional markings might be added to the component.
- 3.3 Alternative means of testing:** n/a
- 3.4 Additional information:** The test results refer to the object(s) specified on the first page of this report exclusively.
- Test site TÜV Saarland automobil GmbH, Am TÜV 1, 66280 Sulzbach, Germany  
 ITM engineering GmbH, Alte Wagshurster Str. 2, 77871 Renchen, Germany
- Test date 2015-08-25 until 2016-04-21
- 3.5 Remarks:** Sample nos. 4, 5 redundant

Technical Report No. TS-110R-004/16  
Applicant: HSME Corporation  
Type: VCHC6 series

#### 4. Test Results

##### 4.1 5A - Overpressure or strength

The sample was subjected to an overpressure test using water at an overpressure of at least 1.5 times the working pressure.

Test Temperature:	20 °C
Test Pressure:	39.0 MPa (= 1.5 x 26.0 MPa)
Hold Time:	180 s

Subsequently, a visual inspection followed by an external leakage test as per ECE R110, Annex 5B, was made.

Result: full compliance, requirements fulfilled

##### 4.2 5B - External Leakage

The sample parts were tested according to the provisions of Annex 5B of ECE-R110. The results are shown in the table below:

Step	Temperature [°C]	Pressure [MPa]		Leakage / Result
		First	Second	
1	-20	26.00	0.3	Bubble-free, < 15 cm <sup>3</sup> /h
2	+20	39.00	0.4	Bubble-free, < 15 cm <sup>3</sup> /h
3	+120	39.00	0.4	Bubble-free, < 15 cm <sup>3</sup> /h

Result: full compliance, requirements fulfilled

##### 4.3 5C - Internal Leakage

The sample parts were tested according to the provisions of Annex 5C of ECE-R110. Results are given in table below:

Step	Temperature [°C]	Pressure [MPa]		Leakage / Result
		First	Second	
1	-20	26.00	0.3	Bubble-free, < 15 cm <sup>3</sup> /h
2	+20	39.00	0.4	Bubble-free, < 15 cm <sup>3</sup> /h
3	+120	39.00	0.4	Bubble-free, < 15 cm <sup>3</sup> /h

Result: full compliance, requirements fulfilled

**4.4. 5L / 4A 3.2.3. - Durability test - Check valve or non-return valve**

The sample was tested for 20,000 cycles according to the provisions given in Annex 5L and Annex 4A, art. 3.2.3 of ECE-R110.

Subsequently and intermediate, internal and external leakage tests acc. Annex 5B & 5C were made.

Step	Cycles	Test pressure [MPa]		Temperature T [°C]	Cycle time t [s]	Medium
		upper	lower			
1	19.200	20.0	< 10.0	+20	10±2	air
2	400	20.0	< 10.0	- 20	10±2	air
3	400	20.0	< 10.0	+120	10±2	air

Result: full compliance, requirements fulfilled

**4.5. 5D - CNG compatibility**

Based on the ISO 1817, the non-metallic material was tested for n-pentane resistance for 72 h at a temperature of 23°C. Subsequently, the samples were dried for 48 h at a temperature of 40°C.

Material:	Requirements	Limit	Actual
HN701D (HNBR)	Volume change after drying	max. 20,0 %	-2.9 %
	Mass change after drying	max. -5,0 %	-2.3 %
Yodoflon F4 (PTFE)	Volume change after drying	max. 20,0 %	0.3 %
	Mass change after drying	max. -5,0 %	0.1 %

Result: full compliance, requirements fulfilled

**4.6. 5E - Corrosion resistance**

The sample was subjected to the corrosion test as per the requirements of ISO CD 15500-2. The test fluid, a 5 m-% NaCl - distilled water solution, was sprayed on the surface of the sample for 144 h. Subsequently leakage tests as per ECE R110, Annex 5B & 5C were made.

Result: full compliance, requirements fulfilled



**4.7. 5F - Resistance to dry heat**

The non-metallic material was exposed to air at the maximum operating temperature (+120°C) for a period of 168 h according to ISO 188. Subsequently, a tensile strength & elongation test was performed.

Material:	Requirements	Limit	Actual
HN701D (HNBR)	Change of tensile strength	max. 25,0 %	16,5,0 %
	Change of ultimate elongation	+10 / -30 %	-8,0 %

The Yodoflon F4 (PTFE) compound was not tested as the resistance to dry heat needs to be proven for thermoplastic elastomers only. However, the temperature resistance of the PTFE for temperatures up to +120°C (no cracking or degradation) was demonstrated.

Result: full compliance, requirements fulfilled

**4.8. 5G - Ozone ageing**

The non-metallic material was exposed at 20% elongation to air with an ozone concentration of 50 parts per hundred million for 72 hours in compliance with ISO 1431/1. Subsequently, the test pieces were checked for cracks.

Material:	Requirements	Result
HN701D (HNBR)	No cracking of the test piece is allowed.	no cracks, level 0
Yodoflon F4 (PTFE)		no cracks, level 0

Result: full compliance, requirements fulfilled

**4.9. 5H - Temperature cycle**

The sample was subjected to 48 temperature cycles between -20°C (lowest operating temperature) up to +120°C (upper operating temperature) at the working pressure of 26.0 MPa and a cycle time of 120 minutes resulting in 96 h in total.

Subsequently, leakage tests as per ECE R110, Annex 5B & 5C were made.

Result: full compliance, requirements fulfilled

**4.10. 5N - Vibration resistance**

The sample was vibration tested acc. annex 5N: fixed in an apparatus and vibrated for 2 hours at 17 Hz with an amplitude of 1.5 mm (0.06 inch) in each of three orientation axes.

Subsequently, leakage tests as per ECE R110, Annex 5B & 5C were made.

Result: full compliance, requirements fulfilled

**4.11. 50 - Operating temperatures**

Operating temperatures [°C]:	-40°C ↔ +120°C "Cold", "C" Assembly on the vehicle engine allowed
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Result: full compliance, requirements fulfilled

**4.12. 4A, art. 3. - Provisions regarding the approval of the non-return valve**

	requirement	result
3.	The non-return valve	
3.1.	The materials constituting the non-return valve which are in contact with the CNG when operating, shall be compatible with the test CNG. In order to verify this compatibility the procedure described in Annex 5D shall be used.	fulfilled
3.2.	Operating specifications	
3.2.1	The non-return valve shall be so designed as to withstand a pressure of 1.5 times the working pressure (MPa) without leakage and deformation.	fulfilled
3.2.2	The non-return valve shall be so designed as to be leak-proof (external) at a pressure of 1.5 times the working pressure (MPa) (see Annex 5B).	fulfilled
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. The non-return valve shall remain leak-proof (external) at a pressure of 1.5 times the working pressure (MPa) (see Annex 5B).	fulfilled
3.2.4	The non-return valve shall be so designed to operate at temperatures as specified in Annex 5O.	fulfilled
3.3.	The non-return valve has to comply with the test procedures for the Class component determined according to the scheme in Figure 1-1 of paragraph 2. of this Regulation.	fulfilled

Result: full compliance, requirements fulfilled

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## 5. Conclusion

The type and variants as described in the information folder (appendix 1) comply with the regulatory requirements referred to on page 1.

With regard to the required level of performance to be achieved, the tested samples were representative for the type to be approved.

The tests were carried out in accordance with the relevant requirements of EN ISO/IEC 17025:2005 and EN ISO/IEC 17020:2012.

There are no safety related technical objections against the use in motor vehicles using CNG in their propulsion system.

Sulzbach/Saar, 2016-04-21  
kuh/beh



Dr.-Ing. Stefan Behrning  
Technical expert

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## Appendix 0

### List of changes

Correction of:	n/a
Modification of:	n/a
Addition of:	n/a
Deletion of:	n/a

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## ECE-R110, Annex 1A

### Essential Characteristics of the CNG/LNG components

<b>1.2.4.5.14.</b>	<b>Non-return valve(s) or check valve(s):</b>	<b>yes</b>
1.2.4.5.14.1.	Make(s):	HSME
1.2.4.5.14.2.	Type(s):	VCHC6 series
1.2.4.5.14.3.	Operating principle:	check-valve/non-return valve (appendix 2 of test report)
1.2.4.5.14.4.	Working pressure(s):	26.0 MPa
1.2.4.5.14.5.	Material	body: SS316 sealing: PTFE, HNBR
1.2.4.5.14.6.	Operating temperatures:	-40°C / +120°C