TÜV Pfalz
TÜV Rheinland Group

**Technischer Bericht**
**Nr. 07-7062-00-01**

| | |
|---|---|
| **Manufacturer's name and address:** | Hy-Lok Corporation<br>1467-1, Songjeong-Dong<br>Gangseo-Gu, Busan 618-817<br>South Korea |
| **Trade name or mark:** | Hy-Lok |
| **Type:** | CNGCV series check valve |
| **CNG component:** | check valve<br>Class according to R110: 0 |
| **Applicable regulation(s):** | ECE R110, CORRIGENDUM 2<br>State of the art |
| **Test report:** | Test report 02-2/07 of TÜV Saarland automobil GmbH |

**Final statement:**
The requirements of the ECE R 110 are met. There are no safety related technical objections. The use of the check valve in CNG driven vehicles is supported.

Laboratory „Technologiezentrum Typprüfstelle Lambsheim des TÜV Pfalz Verkehrswesen GmbH" of the „Akkreditierungsstelle des Kraftfahrt-Bundesamtes", Bundesrepublik Deutschland.
DAR-Registrier-Nr.: KBA-P 00008-95

Lambsheim, 03/01/2007

Technologiezentrum Typprüfstelle Lambsheim Sachverständiger Prüf-Laboratorium EN 45001 TÜV Pfalz Verkehrswesen GmbH

Dipl.-Ing. S. Bauermann
Der amtlich anerkannte Sachverständige
für den Kraftfahrzeugverkehr

# Kraftfahrt-Bundesamt

DE-24932 Flensburg

E1

## MITTEILUNG

ausgestellt von:
**Kraftfahrt-Bundesamt**

über die Genehmigung
für einen Typ eines CNG-Bauteils nach der Regelung Nr. 110

## COMMUNICATION

issued by:
**Kraftfahrt-Bundesamt**

concerning approval granted
of a type of CNG component pursuant to Regulation No. 110

Nummer der Genehmigung: **000162**
Approval No.

Erweiterung:
Extension No.

1. Betreffendes CNG-Bauteil:
CNG component considered:
**Sperr- oder Rückschlagventil**
**Check valve or non-return valve**

2. Fabrik- oder Handelsmarke:
Trade name or mark:
**Hy-Lok**
**Typ/type: CNGCV series check valve**

3. Name und Anschrift des Herstellers:
Manufacturer's name and address:
**Hy-Lok Corporation**
**Gangseo-Gu, Busan 618-817, South Korea**

4. Gegebenenfalls Name und Anschrift des Vertreters des Herstellers:
If applicable, name and address of manufacturer's representative:
**entfällt**
**not applicable**

5. Zur Genehmigung vorgelegt am:
Submitted for approval on:
**21.05.2007**

Nummer der Genehmigung: 000162
Approval No.:

6. Technischer Dienst, der die Prüfungen für die Genehmigungen durchführt:
Technical service responsible for conducting approval tests:
**Technischer Überwachungs-Verein Pfalz Verkehrswesen GmbH**
**DE-67245 Lambsheim**

7. Datum des Gutachtens des Technischen Dienstes:
Date of report issued by that service:
**03.01.2007**

8. Nummer des Gutachtens des Technischen Dienstes:
Number of report issued by that service:
**07-7062-00-01**

9. Die Genehmigung wird **erteilt**
Approval **granted**

10. Grund oder Gründe für die Erweiterung der Genehmigung:
Reason(s) of extension of approval:
**entfällt - not applicable**

11. Ort - Place: **DE-24932 Flensburg**

12. Datum - Date: **30.05.2007**

13. Unterschrift: **Im Auftrag**
Signature:

(Hansen)

KRAFTFAHRT-BUNDESAMT 407

14. Die mit dem Antrag auf Erteilung einer Genehmigung oder Erweiterung eingereichten Unterlagen sind auf Anforderung erhältlich.
The documents filed with the application or extension of approval can be obtained upon request.

Nummer der Genehmigung: 000162
Approval No.:

**Anlage**
**Appendix**

zur ECE-Typgenehmigungs Mitteilung Nr. **000162**
to ECE type-approval certificate No.

1. Zusätzliche Angaben zur Typgenehmigung eines Typs eines CNG-Bauteils nach der Regelung Nr. 110
Additional information concerning the type approval of a type of CNG components pursuant to Regulation No. 110

1.8. Sperr- oder Rückschlagventil(e)
Check valve(s) or non-return valve(s)

| | | |
|---|---|---|
| 1.8.1 | Arbeitsdruck (Arbeitsdrücke):<br>Working pressure(s): | **273 bar; 27,3 MPa bei/at 120°C** |
| 1.8.2 | Werkstoff:<br>Material: | **Gehäuse: Edelstahl 316**<br>**Body: Stainless Steel 316**<br><br>**Dichtungen: NBR, PTFE**<br>**Seals: NBR, PTFE** |

# Kraftfahrt-Bundesamt

DE-24932 Flensburg

Nr. der Genehmigung: 000162
Approval No.:

**- Anlage -**

**Nebenbestimmungen und Rechtsbehelfsbelehrung**

**Nebenbestimmungen**

Jede Einrichtung, die dem genehmigten Typ entspricht, ist gemäß der angewendeten Vorschrift zu kennzeichnen.

Das Genehmigungszeichen lautet wie folgt:

E1 **110 R - 000162**

Die Einzelerzeugnisse der reihenweisen Fertigung müssen mit den Genehmigungsunterlagen genau übereinstimmen. Änderungen an den Einzelerzeugnissen sind nur mit ausdrücklicher Zustimmung des Kraftfahrt-Bundesamtes gestattet.
Änderungen der Firmenbezeichnung, der Anschrift und der Fertigungsstätten sowie eines bei der Erteilung der Genehmigung benannten Zustellungsbevollmächtigten oder bevollmächtigten Vertreters sind dem Kraftfahrt-Bundesamt unverzüglich mitzuteilen.
Verstöße gegen diese Bestimmungen können zum Widerruf der Genehmigung führen und können überdies strafrechtlich verfolgt werden.

Die Genehmigung erlischt, wenn sie zurückgegeben oder entzogen wird, oder der genehmigte Typ den Rechtsvorschriften nicht mehr entspricht. Der Widerruf kann ausgesprochen werden, wenn die für die Erteilung und den Bestand der Genehmigung geforderten Voraussetzungen nicht mehr bestehen, wenn der Genehmigungsinhaber gegen die mit der Genehmigung verbundenen Pflichten – auch soweit sie sich aus den zu dieser Genehmigung zugeordneten besonderen Auflagen ergeben - verstößt oder wenn sich herausstellt, dass der genehmigte Typ den Erfordernissen der Verkehrssicherheit oder des Umweltschutzes nicht entspricht.

Das Kraftfahrt-Bundesamt kann jederzeit die ordnungsgemäße Ausübung der durch diese Genehmigung verliehenen Befugnisse, insbesondere die genehmigungsgerechte Fertigung, nachprüfen. Es kann zu diesem Zweck nach den Regeln der zugrundeliegenden Vorschriften Proben entnehmen oder entnehmen lassen.

Die mit der Erteilung der Genehmigung verliehenen Befugnisse sind nicht übertragbar. Schutzrechte Dritter werden durch diese Genehmigung nicht berührt.

**Rechtsbehelfsbelehrung**

Gegen diese Genehmigung kann innerhalb eines Monats nach Bekanntgabe Widerspruch erhoben werden. Der Widerspruch ist beim **Kraftfahrt-Bundesamt, Fördestraße 16, DE-24944 Flensburg,** schriftlich oder zur Niederschrift einzulegen.

Nummer der Genehmigung: 000162
Approval No.:

**- Attachment -**

**Collateral clauses and instruction on right to appeal**

**Collateral clauses**

All equipment which corresponds to the approved type is to be identified according to the applied regulation.

The approval identification is as follows: - see German version -

The individual production of serial fabrication must be in exact accordance with the approval documents. Changes in the individual production are only allowed with express consent of the Kraftfahrt-Bundesamt.
Changes in the name of the company, the address and the manufacturing plant as well as one of the parties given the authority to delivery or authorised representative named when the approval was granted is to be immediately disclosed to the Kraftfahrt-Bundesamt.
Breach of this regulation can lead to recall of the approval and moreover can be legally prosecuted.

The approval expires if it is returned or withdrawn or if the type approved no longer complies with the legal requirements. The revocation can be made if the demanded requirements for issuance and the continuance of the approval no longer exist, if the holder of the approval violates the duties involved in the approval, also to the extent that they result from the assigned conditions to this approval, or if it is determined that the approved type does not comply with the requirements of traffic safety or environmental protection.

The Kraftfahrt-Bundesamt can at any time check the proper exercise of the conferred authority taken from this approval, in particular the approving standards. For this purpose, samples can be taken or have taken according to the rules of the underlying regulations.

The conferred authority contained with issuance of this approval is not transferable. Trade mark rights of third parties are not affected with this approval.

**Instruction on right to appeal**

This approval can be appealed within one month after notification. The appeal is to be filed in writing or as a transcript at the **Kraftfahrt-Bundesamt, Fördestraße 16, DE-24944 Flensburg.**

TÜV Saarland automobil

TÜV

TÜV Rheinland Group

# Test Report 02-2/07

| | |
|---|---|
| **Manufacturer's name and address:** | Hy-Lok Corporation<br>1467-1, Songjeong-Dong<br>Gangseo-Gu, Busan 618-817<br>South Korea |
| **Trade name or mark:** | Hy-Lok |
| **Type:** | CNGCV series check valve |
| **CNG component:** | check valve<br>Class according to R110: 0 |
| **Applicable regulation(s):** | ECE R110, CORRIGENDUM 2<br>State of the art |

## CONTENTS

## 1 Considered specific component

With its request dated 02/09/2007 the manufacturer Hy-Lok Corporation, 1467-1, Songjeong-Dong, Gangseo-Gu, Busan 618-817, South Korea, applies for the approval of the specific component "check valve", type CNGCV series check valve, according to the ECE regulation 110.
The mandatory tests are based on the requirements of the ECE R110 including CORRIGENDUM 2. They were performed by TÜV Saarland automobil GmbH and witnessed by the authorized Technical Service TÜV Pfalz Verkehrswesen GmbH.

## 2 check valve, type CNGCV series check valve

### 2.1 Intended use

The check valve is designed as an automatic valve which allows gas to flow in only one direction.

| | |
|---|---|
| Operating Temperatures: | -40°C <–> +120°C |
| Service Pressure: | 200 bar / 20 MPa at 15°C |
| Working Pressure: | 273 bar / 27,3 MPa at 120°C |
| Class according to R110: | 0 |

### 2.2 Design

The specific component „check valve" is designed as a spring loaded non-return valve, see technical drawing 2007A23D22, rev. 0.

The following table shows the possible variants:

| type | extension | end connections dimension | |
|---|---|---|---|
| | | inlet | outlet |
| CNGCV | -H16M | 16 mm | |
| | -H10T | 5/8" | |

### 2.3 Materials

The materials to be used including material data and the manufacturing/production parameters are fixed in the manufacturer's documentation and, if adequate, the technical drawings respectively.
Reference is made to the technical drawing 2007A23D22, rev. 0. and the related parts list.

| | |
|---|---|
| **Body and components in contact with gas:** | Stainless Steel 316 |
| **Seals:** | NBR, PTFE |

## 3 Documents to the approval

The test report includes the following documents:
Application form for type approval
Technical Drawing with parts list

## 4 Applicable regulations

ECE R110 including CORRIGENDUM 2
State of the art

## 5 Performed Tests

Subsequent to a detailed design verification the following test plan was defined and the tests performed. The relevant annex is 4A, 3. of the ECE R110.

Table1: Test plan

| No. | Test | Annex ECE R110 | Result |
|---|---|---|---|
| 0 | Designprüfung<br>design review | -- | successful |
| 1 | Überdruckprüfung - Festigkeitsprüfung<br>overpressure test | 5A | successful |
| 2 | Äußere Dichtheitsprüfung<br>external leakage test | 5B | successful |
| 3 | Innere Dichtheitsprüfung<br>internal leakage test | 5C | successful |
| 4 | CNG-/LPG-Beständigkeit<br>CNG / LPG compatibility | 5D | successful |
| 5 | Korrosionsbeständigkeit<br>corrosion resistance test | 5E | successful |
| 6 | Beständigkeit gegen trockene Hitze<br>resistance to dry heat | 5F | successful |
| 7 | Ozonbeständigkeit<br>Ozone ageing | 5G | successful |
| 8 | Dauerhaltbarkeitsprüfung<br>durability test (continued operation) | 5L | successful |
| 9 | Schwingungsfestigkeit<br>vibration resistance test | 5N | successful |

**Table no. 1) Überdruckprüfung – Festigkeitsprüfung (overpressure test)**

A sample part was tested using 1.5 times the working pressure.
temperature: 20°C
test pressure: 410 bar / 41 MPa
hold time: 60 s
Subsequently a visual inspection and an external / internal leakage tests were done.

result: without objections, successful

**Table no. 2) Äußere Dichtheitsprüfung (external leakage test)**

The external leakage tests were done according to the provisions given in annex 5B, 2. and 5O at room temperature, the minimum operating temperature and the maximum operating temperature. The pressures used are given in the table below. The hold time was 180 s, the test gas used was Nitrogen.
In total 5 components were tested (a virgin sample and subsequent to the tests according to annex 5A, annex 5E, annex 5L, and annex 5N).

| step | temperature [°C] | pressure [bar/MPa] |
|---|---|---|
| 1 | -40 | 1/0,1 – 27/2,7 – 273/27,3 |
| 2 | +20 | 1/0,1 – 27/2,7 – 273/27,3 |
| 3 | +120 | 1/0,1 – 27/2,7 – 273/27,3 |

result: without objections, successful

**Table no. 3) Innere Dichtheitsprüfung (internal leakage test)**

The tests were conducted on samples which have previously been subjected to the external leak test of annex 5B. The test set-up was according to the provisions given in annex 5C.
When in the closed position, the check valve shall not leak when subjected to any aerostatic pressure between 0 and 1.5 times the working pressure.

result: without objections, successful

**Table no. 4) CNG-Beständigkeit (CNG compatibility)**

The synthetic parts of the filter in contact with CNG, VITON and PTFE, shall not show excessive volume change or loss of weight. Resistance to n-pentane according to ISO 1817 was tested with the following conditions:

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

Requirements: maximum change in volume 20 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.

result: without objections, successful

**Table no. 5) Korrosionsbeständigkeit (corrosion resistance test)**

According to the provisions of ISO CD 15500-2 a sample (openings plugged) was tested to prove corrosion resistance.
Subsequently a visual inspection and an external / internal leakage tests were done.

result: without objections, successful

**Table no. 6) Beständigkeit gegen trockene Hitze (resistance to dry heat)**

The test was done in compliance with ISO 188. The synthetic sample was exposed to air at a temperature equal to the maximum operating temperature for 168 hours. The allowable change in tensile strength should not exceed + 25 per cent. The allowable change in ultimate elongation shall not exceed a maximum increase of 10 per cent and a maximum decrease of 30 per cent.

result: without objections, successful

**Table no. 7) Ozonbeständigkeit (Ozone ageing)**

The test was in compliance with ISO 1431/1.The synthetic sample, which was stressed to 20 per cent elongation was exposed to air at 40C with an ozone concentration of 50 parts per hundred million during 120 hours. No cracking of the test piece is allowed.

result: without objections, successful

**Table no. 8) Dauerhaltbarkeitsprüfung (durability test (continued operation))**

The component was connected to a source of pressurised dry air by means of a suitable fitting and subjected to a total of 20,000 cycles: 96% of the cycles were done at room temperature, 2% of the cycles at the maximum operating temperature and the minimum operating temperature respectively. A cycle consisted of one opening and one closing of the component within a period of not less than10 ± 2 seconds.
Subsequently a visual inspection and an external / internal leakage tests were done.

result: without objections, successful

**Table no. 9) Schwingungsfestigkeit (vibration resistance test)**

The sample was secured in an apparatus and vibrated for 2 hours at17 Hz with an amplitude of 1.5 mm (0.06 in.) in each of three orientation axes. On completion of 6 hours of vibration the sample was visually inspected and an external leakage test was done.
Subsequently a visual inspection and an external / internal leakage tests were done.

result: without objections, successful

## 6 Conclusion

With its request dated 02/09/2007 the manufacturer Hy-Lok Corporation, 1467-1, Songjeong-Dong, Gangseo-Gu, Busan 618-817, South Korea, applies for the approval of the specific component "check valve", type CNGCV series check valve, according to the ECE regulation 110.
The mandatory tests are based on the requirements of the ECE R110 including CORRIGENDUM 2. They were performed by TÜV Saarland automobil GmbH and witnessed by the authorized Technical Service TÜV Pfalz Verkehrswesen GmbH.

All tests were successful.

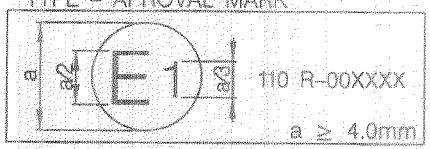
The requirements of the ECE R 110 are met. There are no safety related technical objections.

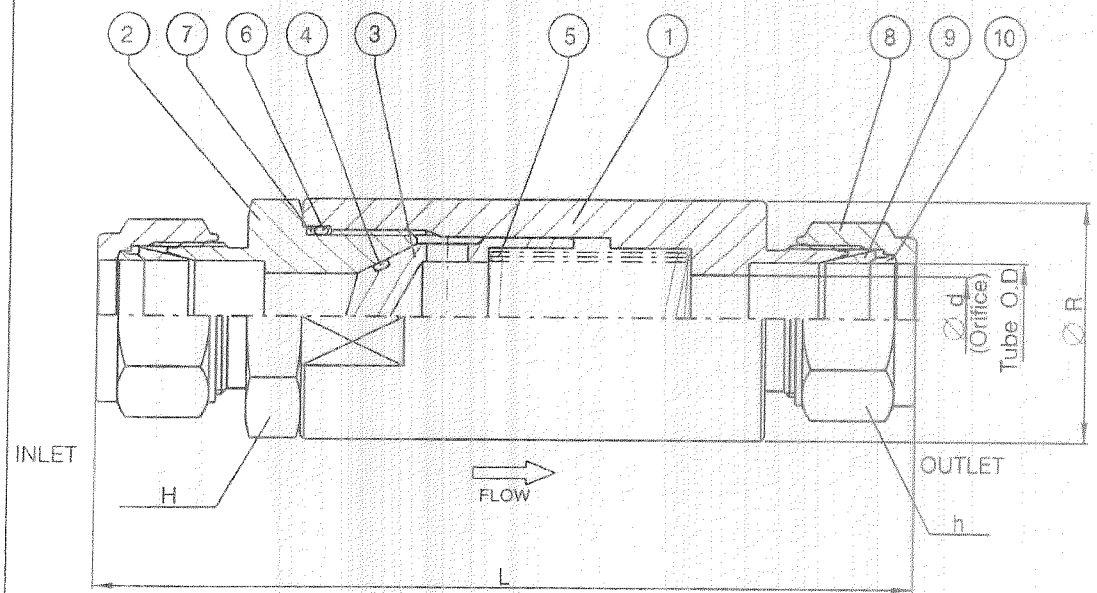
Saarbrücken, 02/28/2007

Technische Überwachung Saarland TÜS 222

Dr.-Ing. Stefan Behrning
aaS, §17 GPSG
TÜV Saarland e.V.

* TYPE - APROVAL MARK




## Specification

1. HY-LOK Corp. Part No. : CNGCV-H***-***
2. Design Pressure Rating : 41.4MPa(6000psig) @100°F(38°C)
3. Cracking Pressure : 0.007MPa(1psig)
4. ECE R 110 Classification of component : Class 0
5. ECE R 110 Working Pressure Rating : 26MPa(3770psi)
6. ECE R 110 Temperature Rating : -40°F to 248°F(-40°C TO 120°C)

(unit : mm)

| Part No. | | End Connections | | Orifice d | L | R | H | h |
|---|---|---|---|---|---|---|---|---|
| | | Inlet | Outlet | | | | | |
| CNGCV | -H16M | 16mm Hy-Lok | | 12.0 | 120.0 | 34.9 | 30.0 | 25.0 |
| | -H10T | 5/8" Hy-Lok | | | | | | 25.4 |

| NO. | Part NO. | DESCRIPTION | MAT'L | Q'TY | REMARK |
|---|---|---|---|---|---|
| 10 | CFB-*** | BACK FERRULE | Stainless Steel 316 | 2 | |
| 9 | CFF-*** | FRONT FERRULE | Stainless Steel 316 | 2 | |
| 8 | CN-*** | Hy-Lok NUT | Stainless Steel 316 | 2 | |
| 7 | KP-U-021SS | BACK-UP RING | PTFE | 1 | |
| 6 | OR2-021 | O-RING | NBR | 1 | |
| 5 | CNGCVSP-1 | SPRING | Stainless Steel 302 | 1 | |
| 4 | OR2-014 | O-RING | NBR | 1 | |
| 3 | CNGCVPP | POPPET | Stainless Steel 316 | 1 | |
| 2 | CNGCVNH-16M | CONNECTOR | Stainless Steel 316 | 1 | |
| 1 | CNGCVBH-16M | BODY | Stainless Steel 316 | 1 | |

| | | | |
|---|---|---|---|
| Part No. | CNGCV-H***-*** | Ref. Dwg. | |
| Date | 2007.03.27 | CHECK VALVE FOR CNG | |
| Scale | N / S | | |
| Approved by | | Dwg. No. 2007A23D22 | Rev. No. 0 |
| Reviewed by | | | |
| Checked by | | | |
| Prepared by | | | |

Hy-Lok 하이록코리아주식회사 HY-LOK CORPORATION

# CHECK VALVE PARTS LIST

## (Model No. CNGCV-H***-***)

Date :2007.02.02

| NO. | Description | Part No. | Mat'l | Size | Manufacturer |
|---|---|---|---|---|---|
| 1 | BODY | CNGCVBH-*** | ASTM A479 TYPE 316 | - | HY-LOK CORPORATION |
| 2 | CONNECTOR | CNGCVNH-*** | ASTM A479 TYPE 316 | - | HY-LOK CORPORATION |
| 3 | POPPET | CNGCVPP | ASTM A479 TYPE 316 | Φ24.0 | HY-LOK CORPORATION |
| 4 | O-RING | OR2-014 | NBR | I.D12.42 x 1.78T | INTERNATIONAL SEAL |
| 5 | SPRING | CNGCVSP-*** | ASTM A313 TYPE 302 | - | KOSWIRE LTD. |
| 6 | O-RING | OR2-021 | NBR | I.D23.52 x 1.78T | INTERNATIONAL SEAL |
| 7 | BACK-UP RING | KP-U-021SS | PTFE | - | DENYON CORPORATION |
| 8 | NUT | CN-*** | ASTM A479 TYPE 316 | - | HY-LOK CORPORATION |
| 9 | FRONT FERRULE | CFF-*** | ASTM A479 TYPE 316 | - | HY-LOK CORPORATION |
| 10 | BACK FERRULE | CFB-*** | ASTM A479 TYPE 316 | - | HY-LOK CORPORATION |
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