TÜV Pfalz
TÜV Rheinland Group

Technischer Bericht
Nr. 07-7063-00-01

Manufacturer's name and address:	Hy-Lok Corporation 1467-1, Songjeong-Dong Gangseo-Gu, Busan 618-817 South Korea
Trade name or mark:	Hy-Lok
Type:	CVH2 series check valve
CNG component:	check valve Class according to R110: 0
Applicable regulation(s):	ECE R110, CORRIGENDUM 2 State of the art
Test report:	Test report 02-3/07 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

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

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

Kraftfahrt-Bundesamt

DE-24932 Flensburg

E 1

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: **000163**
Approval No.

Erweiterung:
Extension No.

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

2. Fabrik- oder Handelsmarke:
Trade name or mark:
Hy-Lok
Typ/type: CVH2 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

Kraftfahrt-Bundesamt

DE-24932 Flensburg

Nummer der Genehmigung: 000163
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:
07-7063-00-01

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: 000163
Approval No.:

Anlage
Appendix

zur ECE-Typgenehmigungs Mitteilung Nr. **000163**
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): Working pressure(s):	**273 bar; 27,3 MPa bei/at 120°C**
1.8.2	Werkstoff: Material:	**Gehäuse: Edelstahl 316** **Body: Stainless Steel 316** **Dichtungen: NBR, PTFE** **Seals: NBR, PTFE**

Kraftfahrt-Bundesamt

DE-24932 Flensburg

Nr. der Genehmigung: 000163
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 - 000163**

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: 000163
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 Rheinland Group

Test Report 02-3/07

Manufacturer's name and address:	Hy-Lok Corporation 1467-1, Songjeong-Dong Gangseo-Gu, Busan 618-817 South Korea
-	
Trade name or mark:	Hy-Lok
Type:	CVH2 series check valve
CNG component:	check valve Class according to R110: 0
Applicable regulation(s):	ECE R110, CORRIGENDUM 2 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 CVH2 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 CVH2 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 2007A23D21, rev. 0.

The following table shows the possible variants:

type	extension	end connections dimension	
		inlet	outlet
CVH2	-H6T	3/8"	
	-H8T	1/2"	
	-H8M	8 mm	
	-H10M	10 mm	
	-H12M	12 mm	

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 design review	--	successful
1	Überdruckprüfung - Festigkeitsprüfung overpressure test	5A	successful
2	Äußere Dichtheitsprüfung external leakage test	5B	successful
3	Innere Dichtheitsprüfung internal leakage test	5C	successful
4	CNG-/LPG-Beständigkeit CNG / LPG compatibility	5D	successful
5	Korrosionsbeständigkeit corrosion resistance test	5E	successful
6	Beständigkeit gegen trockene Hitze resistance to dry heat	5F	successful
7	Ozonbeständigkeit Ozone ageing	5G	successful
8	Dauerhaltbarkeitsprüfung durability test (continued operation)	5L	successful
9	Schwingungsfestigkeit 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 CVH2 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.

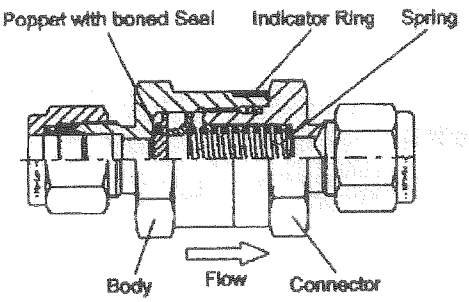
The requirements of the ECE R 110 are met. There are no safety related technical objections.

Saarbrücken, 02/28/2007

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

Introduction

Hy-Lok's 700H Series Check Valves are designed for flow control CNG. Tested and certified for this application per AGA/CGA NGV 3.1.



Features

- Inline check valve.
- Back stopped poppet.
- NBR seat design.
- Cracking pressure inclue : 1/3, 1, 5, 10, 25psi.
- Indicator Ring for easy identify the cracking pressure.
- 100% factory tested.

Material of Construction

Description	Material / ASTM Specification
Body	SS316 / A479
Connector	SS316 / A479
Sealing	NBR
Spring	SS302
Indicator Ring	Stainless Steel

Technical Data

- *Maximum Operating Pressure* : 6000 PSI @ 100°F (38°C)
- *Operating Temperature Range* :
  From -40°F to 250°F (-40°C to 121°C)
- *Flow Coefficient(Cv)* : 0.67 to 4.7

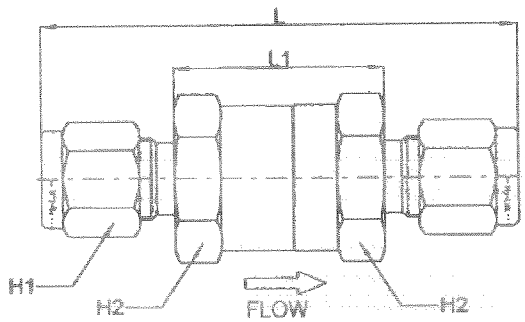
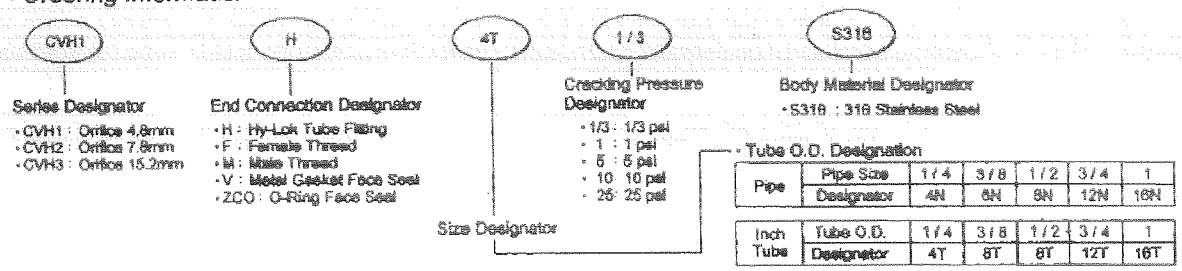


Table of Dimensions

Basic Part No.	End Connection	Hexagon, in.(mm)				Dimensions, in.(mm)	
		h1		h2			
		in.	mm	in.	mm	L1	L
CVH1-H4T	1/4 Hy-Lok	9/16	14.2	11/16	17.46	1.04"(26.4)	2.43"(61.7)
CVH1-M4N	1/4 Male NPT	-	-				2.17"(55.1)
CVH1-ZCO4	1/4" O-Ring Face Seal	-	-				1.98"(50.9)
CVH2-H8T	1/2" Hy-Lok	3/4	22.22	1	25.4	1.23"(31.2)	2.96"(75.2)
CVH2-M8N	3/8" Male NPT	-	-				2.36"(59.9)
CVH2-ZCO8	1/2" O-Ring Face Seal	-	-				2.35"(59.7)
CVH3-H12T	3/4" Hy-Lok	1 1/8"	28.58	1 5/8"	41.28	1.78"(45.2)	3.52"(89.4)
CVH3-M12N	3/4" Male NPT					1.79"(45.5)	3.29"(83.6)
CVH3-ZCO12	3/4" O-Ring Face Seal					1.78"(45.2)	2.90"(73.7)

- Dimensions shown with Hy-Lok nuts in finger-tight position, where applicable.

Ordering Information

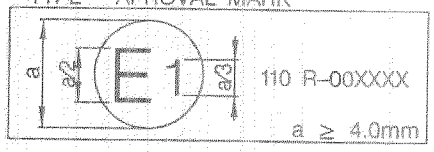


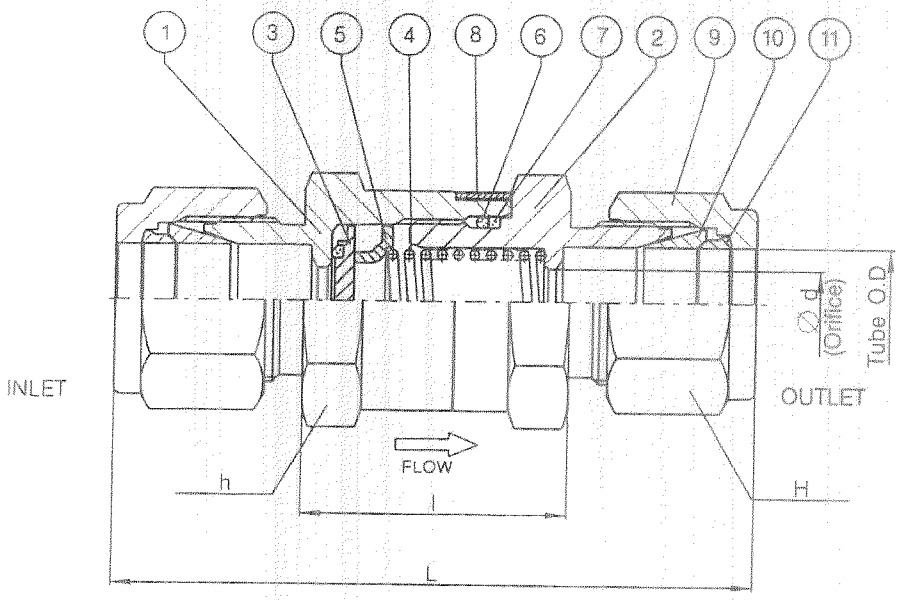
• Tube O.D. Designation

Pipe	Pipe Size	1/4	3/8	1/2	3/4	1
	Designator	4N	6N	8N	12N	16N

Inch Tube	Tube O.D.	1/4	3/8	1/2	3/4	1
	Designator	4T	6T	8T	12T	16T

* TYPE – APROVAL MARK





Specification

1. HY-LOK Corp. Part No. : CVH2-****-***-**
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 Inlet	End Connections Outlet	Orifice d	L	l	h	H
CVH2	-H-6T	3/8" Hy-Lok		7.1	69.9	31.2	25.4	17.46
	-H-8T	1/2" Hy-Lok		7.8	75.2			22.22
	-H-8M	8mm Hy-Lok		6.4	68.6			16.0
	-H-10M	10mm Hy-Lok		7.8	71.1			19.0
	-H-12M	12mm Hy-Lok			75.2			22.0

NO.	Part NO.	DESCRIPTION	MAT'L	Q'TY	REMARK
11	CFB-***	BACK FERRULE	Stainless Steel 316	2	
10	CFF-***	FRONT FERRULE	Stainless Steel 316	2	
9	CN-***	Hy-Lok NUT	Stainless Steel 316	2	
8	CVH2IR	INDICATOR RING	Stainless Steel 316	1	
7	CVH2BR	BACK-UP RING	PTFE	1	
6	OR2-016	O-RING	NBR	1	
5	CVH2PS	STOPPER	Stainless Steel 316	1	
4	CVH2SP-1	SPRING	Stainless Steel 316	1	
3	CVH2PPB	POPPET	Stainless Steel 316	1	with Bonded Seal
2	CVH2N*-***	CONNECTOR	Stainless Steel 316	1	
1	CVH2B*-***	BODY	Stainless Steel 316	1	

Part No.	CVH2-****-***-**	Ref. Dwg.	
Date	2007.03.27	CVH2 Series CHECK VALVE FOR CNG	
Scale	N / S		
Approved by	O M Kim	Dwg. No. 2007A23D21	Rev. No. 0
Reviewed by	K C Song		
Checked by		Hy-Lok 하이록코리아주식회사 HY-LOK CORPORATION	
Prepared by	J H Cho		

CHECK VALVE PARTS LIST

(Model No. CVH2-****-***-**)

Date :2007.02.02

NO.	Description	Part No.	Mat'l	Size	Manufacturer
1	BODY	CVH2B*-***	ASTM A479 TYPE 316	-	HY-LOK CORPORATION
2	CONNECTOR	CVH2N*-***	ASTM A479 TYPE 316	-	HY-LOK CORPORATION
3	POPPET (with Bonded Seal)	CVH2PPB	ASTM A479 TYPE 316	Φ18.0	HY-LOK CORPORATION
			NBR	-	DAIKIN CORPORATION
4	Spring	CVH2SP-***	ASTM A313 TYPE 302	-	KOSWIRE LTD.
5	STOPPER	CVH2PS	ASTM A479 TYPE 316	-	HY-LOK CORPORATION
6	O-RING	OR2-016	NBR	I.D15.6 x 1.78T	INTERNATIONAL SEAL
7	BACK-UP RING	CVH2BR	PTFE	-	DENYON CORPORATION
8	INDICATOR	CVH2IR	ASTM A479 TYPE 316	Φ25.4	HY-LOK CORPORATION
9	NUT	CN-***	ASTM A479 TYPE 316	-	HY-LOK CORPORATION
10	FRONT FERRULE	CFF-***	ASTM A479 TYPE 316	-	HY-LOK CORPORATION
11	BACK FERRULE	CFB-***	ASTM A479 TYPE 316	-	HY-LOK CORPORATION

Hy-Lok 하이록코리아주식회사 HY-LOK CORPORATION