

# VOC PACKING

*K/#VOC-HP21 & CP21*

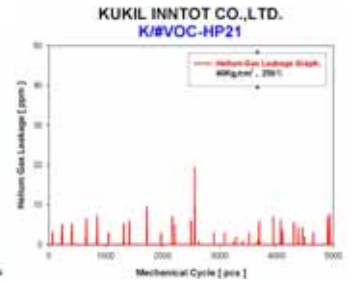


## Specifications

- *MESC SPE 77/312*
- *EPA METHOD 21*
- *TA-LUFT*

*Helium Gas Maximum Leakage : 20 ppm*

*VOC Packing*



1.

가

가

, 가  
 (Volatile Organic Compounds ,  
 " VOC " . )

가



VOC

VOC

가

, Aliphatic ( )

(Precursors)

( Environmental Protstion Agency , " EPA" )  
 ( Clean Air Act , "CAA" )

VOC  
 189

500ppm  
 VOC

100ppm

VOC

가

, 1995

VOC

22

Sealing(Gasket, Packing)

( )

“ & ”

UTM(Gasket Leakage Test M/C), Steam Test

M/C, Gasket Vibration Test M/C, VOC Packing Test M/C, Helitest

Gasket/Packing Test

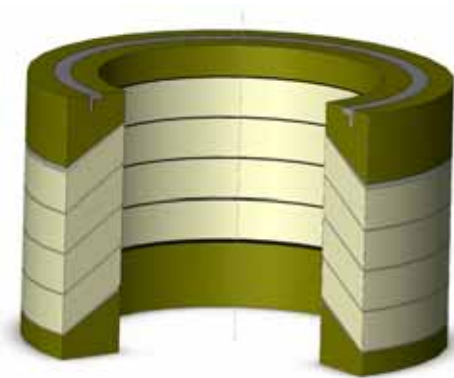
VOC Packing



VOC-HP21

Inconel Yoke Mesh Insert Graphite Braid

Graphite Die Mold



**K/#VOC-HP21**

<b>Top</b>	: Inconel Yoke Mesh Inserted Graphite Braid & SS316L Metal Cap
<b>Middle</b>	: Graphite Die Molded Rings
<b>Bottom</b>	: Inconel Yoke Mesh Inserted Graphite Braid

1) Top

Inconel Yoke Mesh Insert Graphite Braid  
 Inconel Yoke Mesh Valve Stem Packing  
 650  
 Middle Stem Stuffing Box  
 Inconel Yoke Mesh Insert Graphite Braid

2) Middle

Density 1.45~1.7 Low Density  
 Ring 3  
 Top & Bottom Stem Stuffing Box

3) Bottom

Inconel Yoke Mesh Insert Graphite Braid  
 Inconel Yoke Mesh Valve Stem Packing  
 650  
 Middle Stem Stuffing Box

4)

Asbestos 가  
 Inconel Yoke Mesh Insert Graphite Braid Sealing  
 Graphite Crush

Die Mold

Gland Ring

5,000 Cycle Test 50ppm  
가 - Max. 20ppm ( Helium Gas)

Gas Seal

Low Tightening Torque, Low Handle Torque.

Corrosion Inhibitor Graphite Valve Stem Valve Body

5)

Temperature

Non-Oxidation : -240 ~ 1,650

Oxidation : -240 ~ 650

Pressure : Class 150LB ~ 2500LB

(2) K/#VOC-CP21

Packing ( Square )	K/#VOC-CP21 ( Cup & Cone )
가 Stem Torque 가 가. Gland Bolt Torque , Cup & Cone Valve Handle Torque가 PTFE Graphite Stem Graphite 가 Packing Leak .	( ) 가 Stem Torque 가 가 . Valve Handle Torque가 Valve Low Tightening Torque, Low Handle Torque. Graphite PTFE

VOC-CP21

, VOC-HP21

PTFE Braid Graphite+PTFE Die Mold



**K/#VOC-CP21**

- Top** : Teflon + Graphite + Teflon Fiber Packing & SS316L Metal Cap
- Middle** : Teflon + Graphite Die Molded Rings
- Bottom** : Teflon + Graphite + Teflon Fiber Packing & SS316L Metal Cap

1) Top / Bottom

Teflon Tape    Graphite Tape    Teflon  
 가 ,    Graphite가    Cushion    Stem  
 가 , /  
 Teflon    Teflon Fiber Packing

2) Middle

Teflon Tape    Graphite Tape    Teflon  
 가 ,    Graphite가    Cushion    Stem    가  
 , /  
 가    1

3)

Ring Packing ( , )	Teflon + Graphite + Teflon Fiber Packing
Mold Packing ( )	Teflon + Graphite
Metal Cap	Stainless Steel

4)

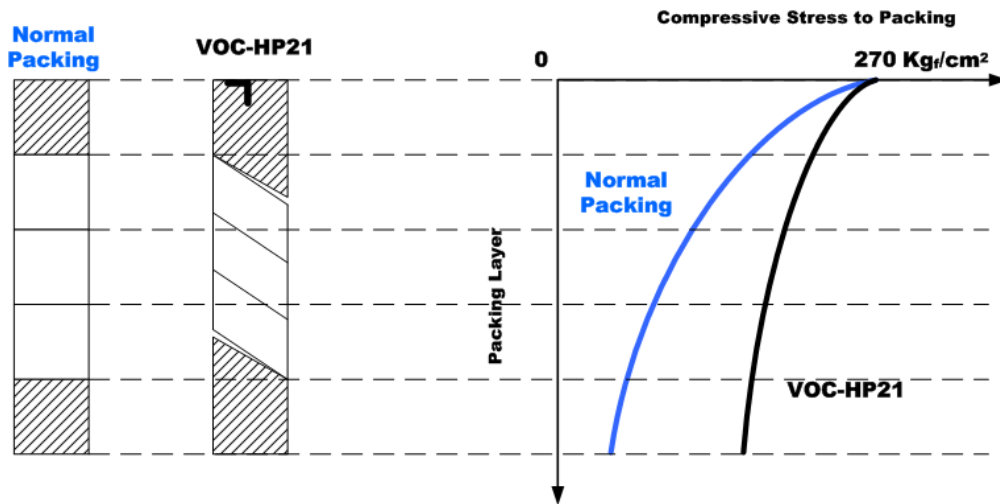
Asbestos 가  
 Graphite    Stem    Cycle    Stem  
 PTFE    PTFE    , Graphite  
 PTFE    Die Mold  
 Die Mold  
 Gland Ring ,  
 . ( )

Low Tightening Torque, Low Handle Torque.

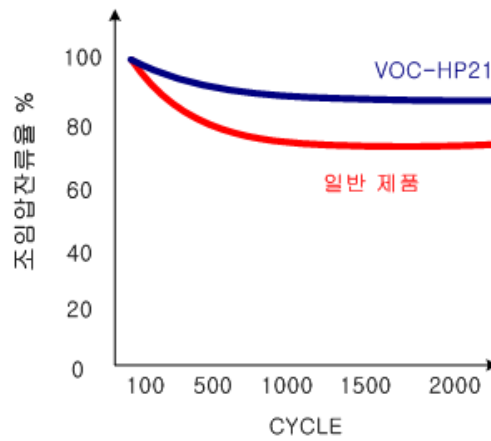
5)

Temperature : -196 ~ 150  
 Pressure : Class 150LB ~ 2500LB

(2) Packing Graph.



(3) Cycle Graph.



(4)

- Steam
- Water
- Gases
- Heat medium
- Oil
- Hydrocarbon
- Organic solvents
- Volatile organic compounds
- LNG
- Extremely low temperature fluids
- Etc.



### 3.

#### (1) K/#VOC-HP21

##### 1) Date and Place of Inspection

On Sep. 30 & Oct. 1, 2008 at The Korea Seal Industries Institute in Ulsan, Korea

##### 2) Test Item

KUKIL INNTOT CO., LTD. VOC Packing K/#VOC-HP21

##### 3) Test Conditions

Type of Packing : KUKIL K/#VOC-HP21

Size of Packing : OD46 x ID30 x 39H

Test Fluid : 99.99% Helium Gas

Test Pressure : 40 Kg/cm<sup>2</sup>

Gland Bolt Torque : 300Kg<sub>f</sub>.cm

Test Temperature : 250

Number of Thermal Cycles : 2 pcs

Total Number of Mechanical Cycles : 5,000 pcs

Stem(Shaft) Travel : 50mm

Cycling Rate : 15sec/cycle

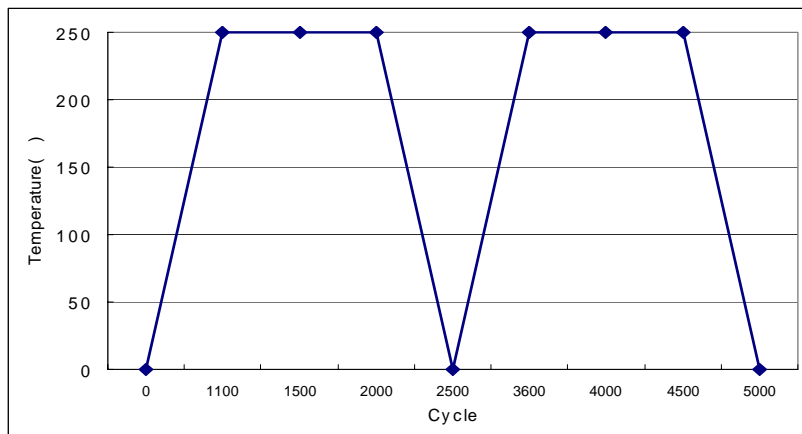
Gas Detector : Helitest 969-3501

Test Reference : MESC SPE 77/312, EPA METHOD 21, TA-LUFT

#### 4) Particulars of K/#VOC-HP21

- Top : Inconel Yoke Mesh Inserted Graphite Braid & SS316L Metal Cap
- Middle : Graphite Die Molded Rings
- Bottom : Inconel Yoke Mesh Inserted Graphite Braid

#### 5) Thermal Cycle





6) Gland Bolt Re-Torque Notes - 2,563 Cycle Time

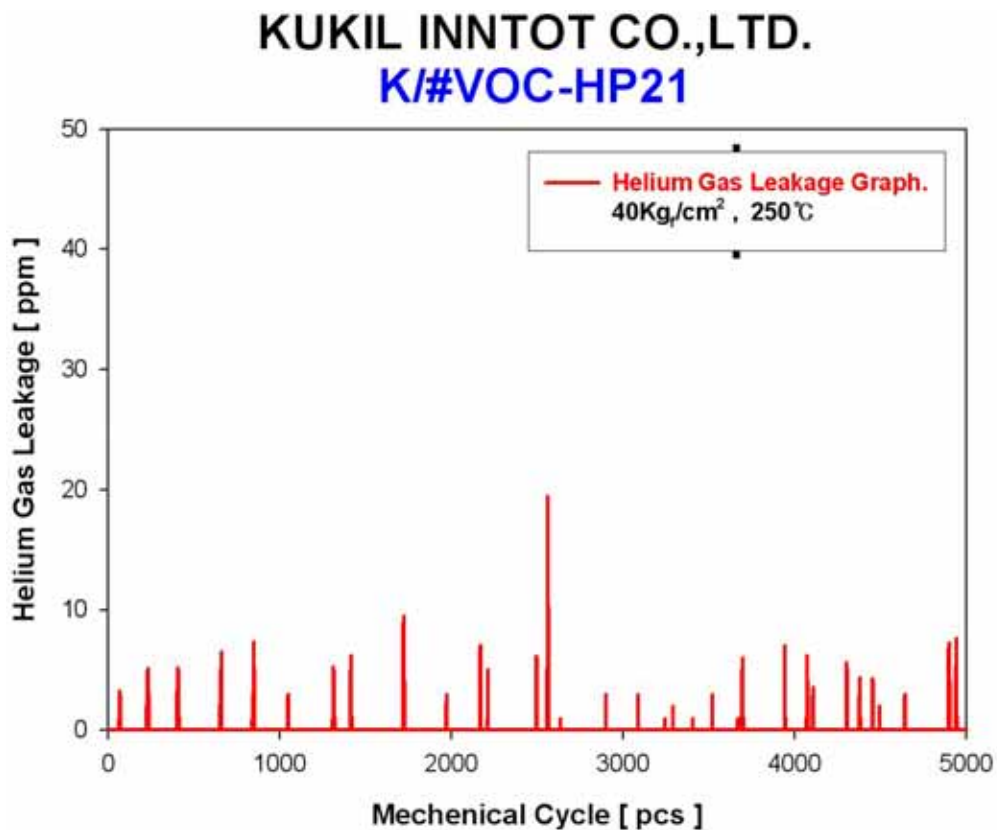
	Static Leakage (PPMv)	Before Adjustment		After Adjustment		
		Bolt Torque(Kgr.cm)		Bolt Torque(Kgr.cm)		Gland
		Left	Right	Left	Right	Height
1	20	210	205	300	300	15.0
2	-	-	-	-	-	-

7) Gland Bolt Torque at End of Test

	Left	Right
Gland Bolt Torque at End of Test (Kgr.cm)	225	215

8) Results

*Leak Measured at Test Temperature - Maximum Leakage : 20 ppm*



**(2) K/#VOC-CP21**

**1) Date and Place of Inspection**

On Mar. 13 , 2001 at The Korea Seal Industries Institute in Ulsan, Korea

**2) Test Item**

KUKIL INNTOT CO., LTD. VOC Packing K/#VOC-CP21

**3) Test Conditions**

**Type of Packing :** KUKIL K/#VOC-CP21  
**Size of Packing :** OD46 x ID30 x 48H  
**Test Fluid :** 99.99% Helium Gas  
**Test Pressure :** 10 Kg<sub>f</sub>/cm<sup>2</sup>  
**Gland Bolt Torque :** 400Kg<sub>f</sub>.cm  
**Test Temperature :** -150  
**Gas Detector :** Helitest 969-3501  
**Holding Time :** 20 min

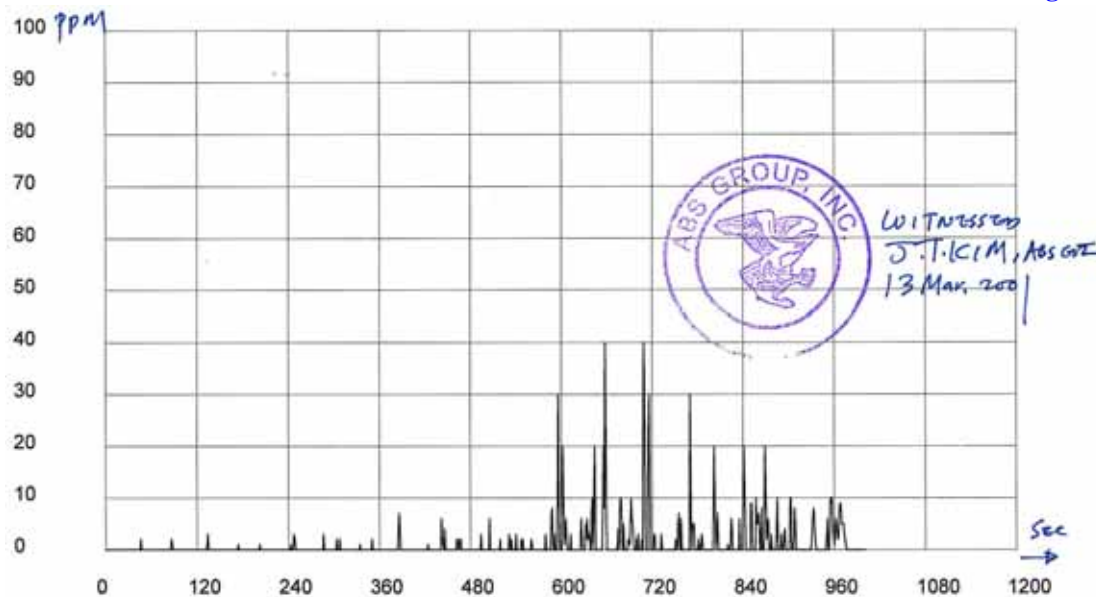
**4) Particulars of K/#VOC-CP21**

Top : Teflon + Graphite + Teflon Fiber Packing & SS316L Metal Cap  
Middle : Teflon + Graphite Die Molded Rings  
Bottom : Teflon + Graphite + Teflon Fiber Packing & SS316L Metal Cap

**5) Result**

***Leak Measured at Test Temperature - Maximum Leakage : 40 ppm***

**Helium Gas Leakage Graph.  
10Kg<sub>f</sub>/cm<sup>2</sup> , -150**



## 4. Torque

K/# VOC-HP21 & CP21 Valve (Class)

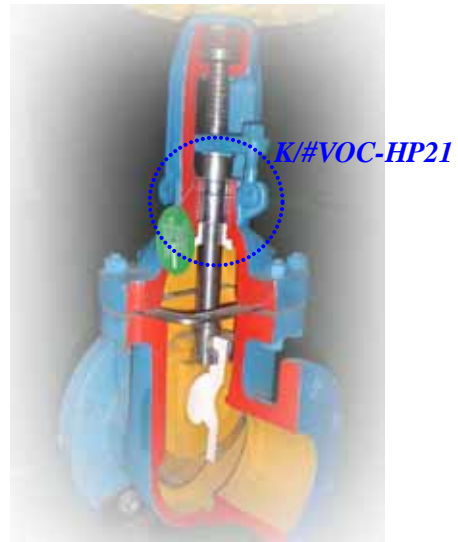
Class		Torque
Class	Compressive stress [ kgf/cm <sup>2</sup> ]	$T = \frac{0.2 d \pi \delta_g (d_o^2 - d_i^2)}{4n}$
150	Min. 270	T : Torque per Grand Bolt [ Kg <sub>f</sub> .cm ] d : Bolt Dia. [ cm ] d <sub>o</sub> : Outside Dia. of Packing [ cm ] d <sub>i</sub> : Inside Dia. of Packing [ cm ] g : Compressive Stress to Packing [ Kg <sub>f</sub> /cm <sup>2</sup> ] n : Q'ty Grand Bolt
300	Min. 270	
600	Min. 270	
900	Min. 300	
1500	Min. 350	
2500	Min. 400	

Torque  
VOC-HP21

,  
Packing  
Re-Bolt

Torque

90 ~ 110%



5.

Valve Stem Packing - Re-Packing K/#101AC(BC) & Braid

(1) Packing

Valve Stuffing Box Packing ,  
 Stuffing Box Stem ,  
 Stem : 32AARH, Stuffing Box : 125AARH .

(2) Size

Packing Size ,  
 Stem OD 가 Stuffing Box .  
 Stuffing Box :  
 Stuffing Box :  
 Stem :

$$Packing\ 의\ 폭 = \frac{(Stuffing\ Box\ ID - Stem\ OD)}{2}$$

$$Packing\ 의\ 높이 = Packing\ 의\ 폭$$

$$Packing\ 의\ 단수 = \frac{Stuffing\ Box\ 높이}{Packing\ 의\ 폭}$$

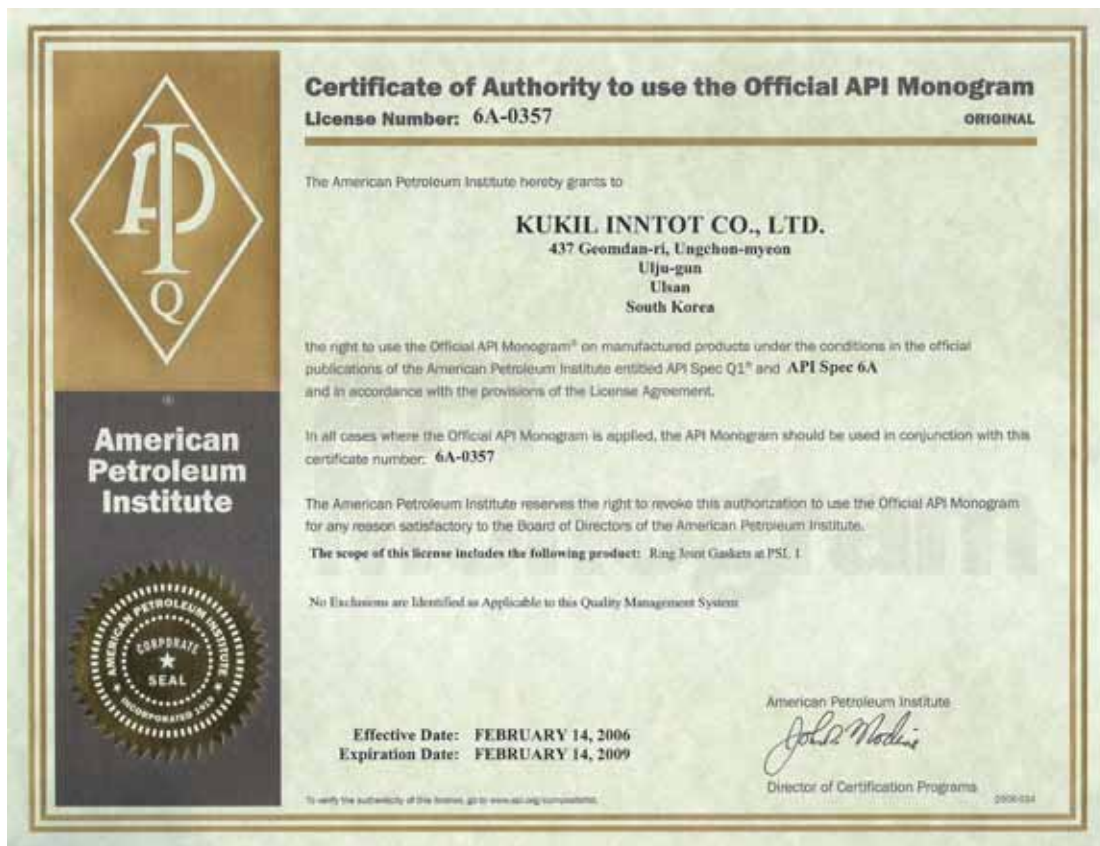
(3) Cutting

Ring , Braid Valve Stuffing Box  
 K/#101AG(BG) ( ) ,  
 Braid Packing , Cutting  
 Stem OD 가 Round Bar Braid Cutting.  
 Valve Packing Cutting.  
 Cutting Cutting ,  
 45 ° 가 Cutting .

(4)

Stuffing Box  
 1 Ring , Stuffing Box  
 90 ° 가  
 ex) 1 Ring (12 ) , 2 Ring(3 ) , 3 Ring(6 ) 4 Ring(9 )  
 Gland Ring Gland Flange  
 Gland Flange , Packing 25%~30%  
 가  
 Valve Handle 5 Cycle( Open/Close ) Packing ,

## 6. Certification



## Approved by SHELL – SPE 85/200 Guidance for packing brands and styles

PRODUCT GROUP CODE	85.AA.AV	85.AA.AW	85.AA.AX	85.AA.AY	85.AA.AZ
Graphite cup+cone or wedge rings					
Revision					6-7-2000
TYPE	4A	4A	4C	4D	4E
MESC range	85	85	85	85	85
SELECTION OF PACKING MAKES AND STYLES RELATED TO APPLICATION AND PROPERTIES	Diamond textured extoliate graphite(99%) tape, made to angled cup and cone rings, plus top +bottom rings of braided graphite filament yam+lubricants +high temp blocking agents	5 ring set consisting of top & bottom rings: -graphite & PTFE -braided PTFE -with SS-316 cap intermediate rings: -graphite & PTFE cover -with corrosion inhibitor	5 ring set consisting of top & bottom rings: -graphite cover -braided graphite SS-321 wire reinforced -with SS-316 cap intermediate rings: -molded graphite -with corrosion inhibitor	5 ring set EPS-2 consisting of two G581 graphite deformed top +bottom rings and three N267 middle rings in W from compressed	97% CARBON DIE FORMED WEDGE RING SETS WITH INORGANIC CORROSION INHIBITORS
VALVES					
-gate, globe, ball, needle and butterfly valves	X	X	X	X	X
-control valves	X	X	X	X	X
ROTATING EQUIPMENT					
-rotary pumps	-	-	-	-	-
-recip pumps	-	-	-	-	-
STATIC EQUIPMENT					
-heat exchangers	-	-	-	-	-
GAS MEDIUM					
Oxygen	X	X	X	X	X
Hydrogen	X	X	X	X	X
Volatile organic compounds	X	X	X	X	X
Steam:saturated	X	-	X	X	X
Steam:superheated	X	-	X	X	X
LIQUID MEDIUM					
Alkali+acid:strong conc	X	X	X	X	X
Alkali+acid:thin conc	X	X	X	X	X
Hot oil+santotherm	X	X	X	X	X
Tar+bitumen	X	X	X	X	X
HF Alkylate	X	X	X	X	X
Hydrocarbons	X	X	X	X	X
LNG	X	X	X	X	X
Oils+Hats	X	X	X	X	X
Solvents	X	X	X	X	X
Salt solutions	X	X	X	X	X
Water:hot	X	X	X	X	X
Water:brackish+sea	X	X	X	X	X
MECHANICAL PROPERTIES					
Pressures (barg) note 3 static/rot/recip, appl's	690/ /	350/ /	350/ /	415/ /	317/ /
TEMPERATURE RANGE (degr.C)see note 3	-130/ +650	-240 +200	-70/ +650	-130/+535	-240/ +450
PXT(see note 10) (barg x degr.C)	Not specified	Not specified	Not specified	Not specified	Not specified
MAX. VELOCITY (m/s) see note 5	Not specified	2	3	Not specified	Not specified
PXV(note 10) (bar x m/s)	Not specified	Not specified	Not specified	Not specified	Not specified
pH RANGE	0-14	0-14	0-14	0-14	0-14
Minimum density (g/cm <sup>3</sup> ):					
-top and bottom rings		2	1.5		
-intermediate rings:		1.5	1		
Fire test(API 589, API 607)	Passes	Passes	Able to meet	?	Passed
Fugitive VOC emission (methane), no re-torque T and 4000 cycles	<100 ppm @ max. P and T=70C & 1000 cycles	<10 ppm @ 12 bar, T=70C & 1000 cycles	<20 ppm @ 12 bar, T=650 C & 1000 cycles	?	Not specified
MANUFACTURER	PACKING STYLE NO.	PACKING STYLE NO.	PACKING STYLE NO.	PACKING STYLE NO.	PACKING STYLE NO.
CHESTERTON					5800 G, 5800R
FLEXTITALUC	EN/R/OFLEX 500			Not available	Not available
GARLOCK	Not accepted			Not available	Not available
JM CLIPPER	C-1/AF-2(pending)			C-1/AF-2(pending)	Clipper graph(pending)
John CRANE	Not available			ESP-2(G581Z+N267)	ESNot available
KUKIL INDUSTRIES CO LTD	n.a	VOC-CP-21	VOC-HP-21	n.a	n.a
Utex Industries	Not available			Not available	Not available



Cert. No.: 1999805-01

Project No.: 1999805

Date Issued: 2 October 2008

Office: Busan, Korea

### INSPECTION CERTIFICATE

**THIS IS TO CERTIFY THAT** the undersigned representative to ABS Consulting, Inc., Korea did, at the request of Kukil Inntot Co., Korea, attend at the place mentioned below on the 30<sup>th</sup> day of September and the 1<sup>st</sup> day of October 2008 in order to witness Fugitive Emission Test on the item hereunder mentioned with the following test details and the results:

### FUGITIVE EMISSION TEST

**Date and Place of Test:** 30<sup>th</sup> September and 1<sup>st</sup> October 2008 at the Korea Seal Industries Institute, Ulsan, Korea

**Test Item:** VOC Packing K/#VOC-HP21 manufactured by Kukil Inntot Co., Ltd.

**Test Conditions:**

Type of Packing::	Kukil K/#VOC-HP21
Size of Packing:	OD46 x ID30 x 39H
Test Fluid:	99.9% Helium Gas
Test Pressure:	40Kgf/cm <sup>2</sup>
Gland Bolt Torque:	300kgf.cm
Test Temperature:	250°C
Number of Thermal Cycles:	2 pcs
Total number of Mechanical Cycles:	5,000 pcs
Stem (Shaft) Travel:	50mm
Cycling Rate:	15sec/cycle
Gas Detector:	Helitest 969-3501
Test Reference:	MESC SPE 77/312, EPA Method 21, TA-LUFT

**Particulars of K/#VOC-HP21:**

Top: Inconel Yoke Mesh Inserted Graphite Braid & SS316L Metal Cap  
 Middle: Graphite Die Molded Rings  
 Bottom: Inconel Yoke Mesh Inserted Graphite Braid

**Test Results:**

Leak measured at test temperature - Maximum leakage: 20ppm

Inspection made without prejudice

  
 J. P. Oh  
 Technical Representative  
 ABS Consulting, Inc., Korea



**Attachment:** K/#VOC-HP21 Fugitive Emission Test Report-Test Data  
 E-20081001-01

This certificate or report is granted or issued subject to the condition that it is understood and agreed that nothing herein shall be deemed to relieve any designer, manufacturer, seller, supplier, repairer or operator of any warranty, express or implied and ABSGI liability shall be limited to the acts and omissions of its employees, agents and subcontractors. Under no circumstance whatsoever shall be ABSGI liable for any injury or damage to any person or property occurring by reason of negligent operation, misuse of or any defect in materials, machinery, equipment or other items other than defects in items actually inspected by ABSGI and ascertainable by normally accepted testing standards, or defects reflected in documents reviewed by ABSGI and which are covered by this certificate or report.

**SAFETY. QUALITY. ENVIRONMENT**

WEB SITE: <http://www.abs-group.com>



Report No. KSI-20081002-01

437, Kumdan-Ri, Woogchon-Myun, Ulju-Kun, Ulsan, Korea

TEL.052-228-7500

FAX.052-268-5578

## FUGITIVE EMISSION TEST REPORT

### Date and Place of Inspection

On Sep. 30 & Oct. 1, 2008 at The Korea Seal Industries Institute in Ulsan, Korea

### Test Item

KUKIL INNTOT CO., LTD. VOC Packing K/#VOC-HP21

### Test Conditions

Type of Packing : KUKIL K/#VOC-HP21  
Size of Packing : OD46 x ID30 x 39H  
Test Fluid : 99.99% Helium Gas  
Test Pressure : 40 Kg/cm<sup>2</sup>  
Gland Bolt Torque : 300Kg.cm  
Test Temperature : 250 °C  
Number of Thermal Cycles : 2 pcs  
Total Number of Mechanical Cycles : 5,000 pcs  
Stem(Shaft) Travel : 50mm  
Cycling Rate : 15sec/cycle  
Gas Detector : Helitest 969-3501  
Test Reference : MESC SPE 77/312, EPA METHOD 21, TA-LUFT

### Particulars of K/#VOC-HP21

Top : Inconel Yoke Mesh Inserted Graphite Braid & SS316L Metal Cap  
Middle : Graphite Die Molded Rings  
Bottom : Inconel Yoke Mesh Inserted Graphite Braid

### Results

Leak Measured at Test Temperature - Maximum Leakage : 20 ppm

### ※ Attachment

K/#VOC-HP21 Fugitive Emission Test Report - Test Data  
E-20081001-01



  
2008.10.02  
E. H. SON

  
2008.10.02  
H. W. CHO

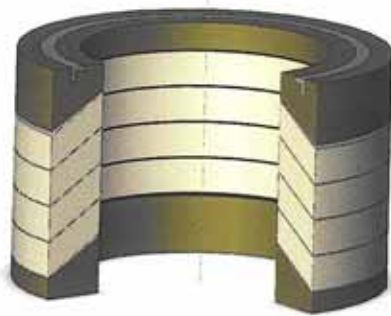
  
2008.10.02  
K. D. KIM



K/#VOC-HP21 FUGITIVE EMISSION TEST REPORT - TEST DATA

**FUGITIVE EMISSION TEST REPORT - TEST DATA**

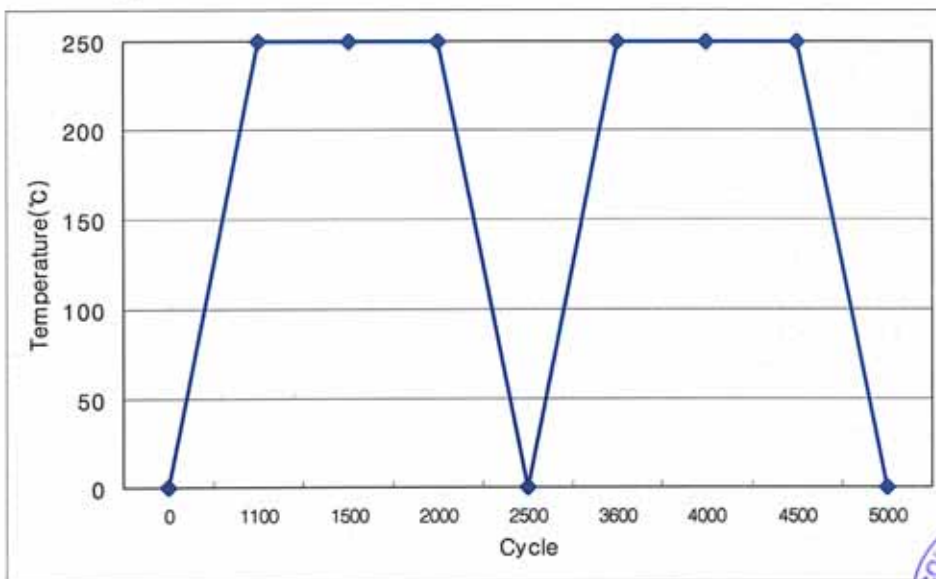
**Particulars of K/#VOC-HP21**



**K/#VOC-HP21**

- Top** : Inconel Yoke Mesh Inserted Graphite Braid & SS316L Metal Cap
- Middle** : Graphite Die Molded Rings
- Bottom** : Inconel Yoke Mesh Inserted Graphite Braid

**Thermal Cycle**



K/#VOC-HP21 FUGITIVE EMISSION TEST REPORT - TEST DATA

Test Results

Cycle Number	Temp. (°C)	Stem Seal Leakage Readings(ppm)	Gland Bolt Re-Torque	Torque (Kg.cm)	
		Maximum		Left	Right
0	22	0	-	300	300
30	22	0	-	300	300
100	37	3	-	270	280
200	59	5	-	270	275
300	56	0	-	270	275
400	113	5	-	260	255
500	149	0	-	260	255
600	154	6	-	260	250
700	189	0	-	250	245
800	211	7	-	250	250
900	223	0	-	245	250
1000	241	3	-	250	250
1100	250	0	-	225	230
1200	250	0	-	245	245
1300	250	5	-	225	230
1400	250	6	-	210	215
1500	250	0	-	215	225
1600	250	0	-	210	215
1700	250	9	-	200	210
1800	250	0	-	220	225
1900	250	3	-	225	230
2000	250	0	-	205	210
2100	214	7	-	215	220
2200	181	5	-	210	225
2300	157	0	-	215	220
2400	112	6	-	215	220
2500	77	20	1 (2,563 Time)	210	205
2600	34	1	-	295	290
2700	55	0	-	295	290
2800	90	3	-	285	275
2900	110	3	-	290	265
3000	143	0	-	285	275
3100	155	3	-	275	265
3200	180	0	-	275	265
3300	220	2	-	270	260
3400	234	1	-	270	260



K/#VOC-HP21 FUGITIVE EMISSION TEST REPORT - TEST DATA

Cycle Number	Temp. (°C)	Stem Seal Leakage Readings(ppm)	Gland Bolt Re-Torque	Torque (Kg.cm)	
		Maximum		Left	Right
3500	247	3	-	270	260
3600	250	1	-	270	260
3700	250	2	-	265	260
3800	250	0	-	265	260
3900	250	7	-	280	260
4000	250	6	-	280	260
4100	250	0	-	280	260
4200	250	0	-	280	255
4300	250	5	-	280	255
4400	250	0	-	280	255
4500	250	4	-	285	280
4600	216	3	-	270	265
4700	185	0	-	255	260
4800	159	2	-	235	255
4900	108	7	-	230	225
5000	88	0	-	225	215

Gland Bolt Re-Torque Notes - 2,563 Cycle Time

	Static Leakage (PPMv)	Before Adjustment		After Adjustment		
		Bolt Torque(Kg.cm)		Bolt Torque(Kg.cm)		Gland
		Left	Right	Left	Right	Height
1	20	210	205	300	300	15.0
2	-	-	-	-	-	-

Gland Bolt Torque at End of Test

	Left	Right
Gland Bolt Torque at End of Test (Kg.cm)	225	215



K/#VOC-HP21 FUGITIVE EMISSION TEST REPORT - TEST DATA

Test M/C & Helitest ( Helium Gas Detector )



Model No. 969-3501



Test Pressure - 40Kg/cm<sup>2</sup>



Test Temperature & Cycles(Final)



Test Product ( Before & After )



Before of Test

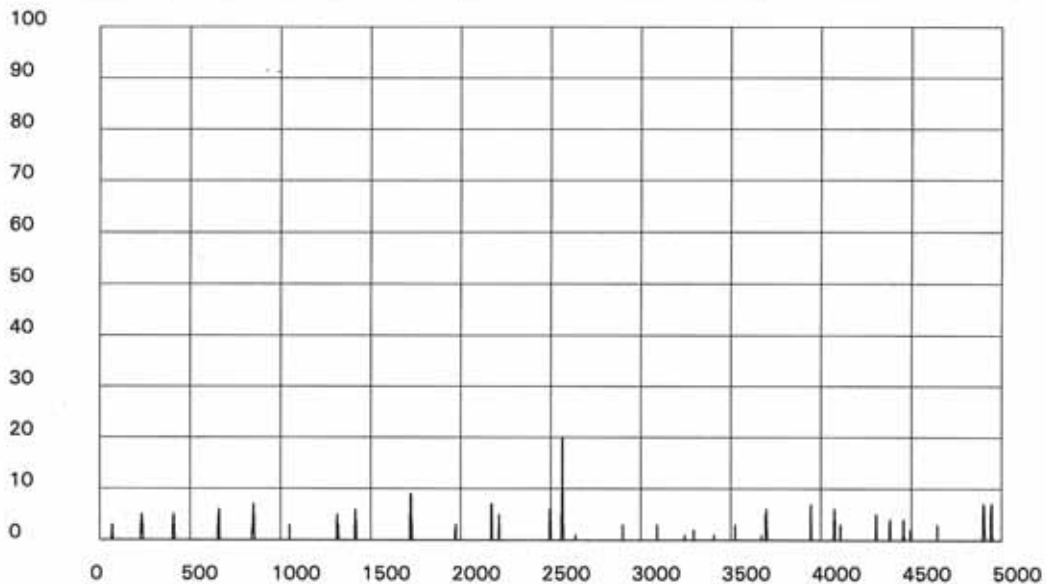


After of Test



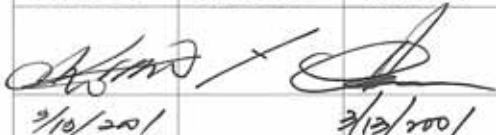
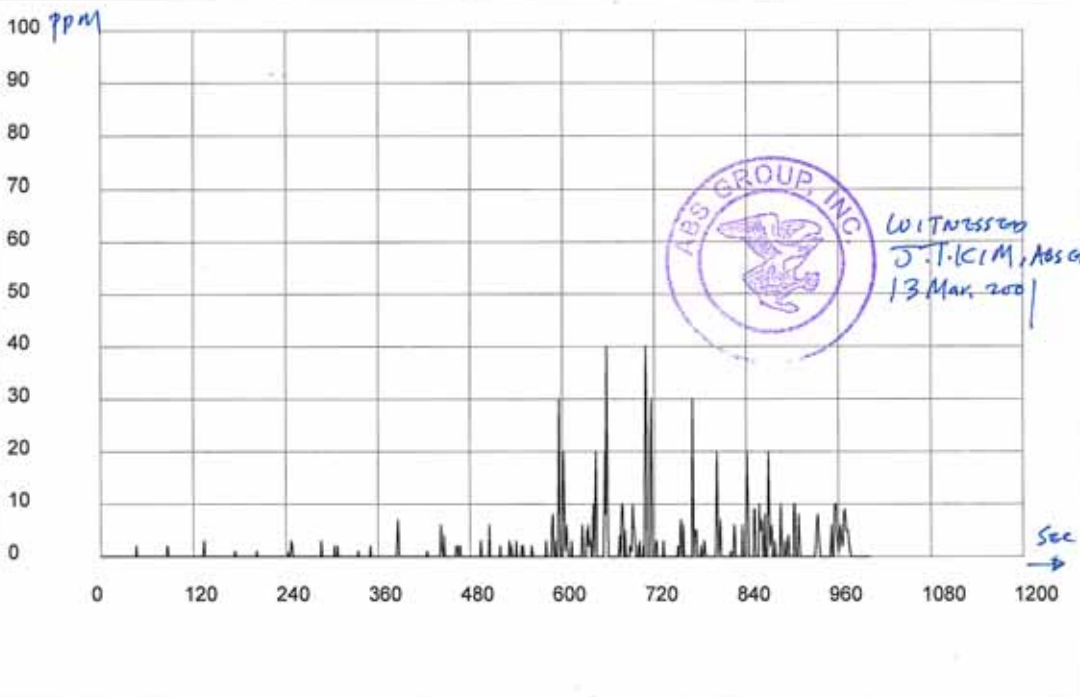
02/01/08

TEST REPORT				PRE'D BY	REV'D BY	APP'D BY
				2008.10.02	2008.10.02	2009.10.02
Certificate No.	E-20081001-01		Test Equipment	VALVE CYCLE TEST M/C		
Issued Date	2008-10-01		Test Date	2008-09-30 ~ 10-01		
Test Place	KOREA SEAL INDUSTRIES INSTITUTE					
Product	Name		Style No.		Dimension	
	VOC PACKING		K/# VOC- HP21		45*30*39H	
Conditions	Pressure (kgf/cm2)	Temperaure (°C)	Cycle Time (sec)	Cycle (cycle)	Stem Travel (mm)	Bolt Torque (kgf-cm)
	40	250	15	5000	50	300
Results	Initial Leakage (ppm)		Maximum Leakage (ppm)		Handle Torgue (kgf-cm)	
	0.0E+0		2.0E+1		-	



Remarks	<ul style="list-style-type: none"> <li>◆ Test Reference: MESC SPE 77/312. EPA METHOD21. TA-LUFT.</li> <li>◆ Particulars of VOC Packing                      Top: Inconel Yoke Mesh Inserted Graphite Braid + Metal Cap(SS316L).                      Middle : Gathered Graphite Die-Form.                      Bottom : Inconel Yoke Mesh Inserted Graphite Braid.</li> <li>◆ Gland Bolt Re-Torque: 2563 Cycle Time(300Kgf.cm)</li> </ul>	
	<p align="center"><b>KUKIL INDUSTRIES CO.,LTD.</b>                  TEL: (052) 269-4975 FAX: (052) 268-5578</p>	



TEST REPORT				PRE'D BY	REV'D BY	APP'D BY
				 3/10/2001		
Certificate No.	Q-20010313-03		Test Equipment	VALVE CYCLE TEST M/C		
Issued Date	2001-03-13		Test Date	2001-03-13		
Test Place	KOREA SEAL INDUSTRIES INSTITUTE					
Product	Name	Style No.		Dimension		
	VOC PACKING		K/# VOC CP-21		56H*46*30	
Conditions	Pressure (kgf/cm <sup>2</sup> )	Temperaure (°C)	Cycle Time (sec)	Cycle (cycle)	Stem Travel (mm)	Bolt Torque (kgf-cm)
	10	-150 ± 10	1200	Non.	45	400
Results	Initial Leakage (ppm)		Maximum Leakage (ppm)		Handle Torgue (kgf-cm)	
	0.0E+0		4.0E+1		170	
						
Remarks	◎ 시험 전 PACKING을 TORQUE 400 Kgf · cm로 장착하고 시험하는 동안 RE-BOLITING 하지 않음. ◎ STEM을 고정 한 상태에서 20분간 TEST.					

KUKIL INDUSTRIES CO.,LTD.  
 TEL: (052) 269-4975 FAX: (052) 268-5578

## CHEMICAL RESISTANCE TABLE

A distinction is made between three cases:

resistant	O
not resistant	X
reservedly resistance	B

In the third case chemical resistance is governed by the operating mode, service temperature and concentration. Users are advised to consult the seal manufacturer or SGL GROUP.

Referred to SIGRAFLEX 

NO	Media	Graphite	Non-Asb.	PTFE
1	Acetaldehyde	O		O
2	Acetamide	O		O
3	Acetate of copper	O		O
4	Acetone	O	B	O
5	Acetylene	O	O	O
6	Acrylic acid (water free)	O		O
7	Acrylonitrile	O		O
8	Adipic acid	O		O
9	Alum	O	O	O
10	Aluminium acetate	O		O
11	Aluminium chlorate	O		O
12	Aluminium chloride	O		O
13	Aluminium fluoride	O		O
14	Aluminium sulphate	O		O
15	Ammonia	O	O	O
16	Ammonia, gaseous	O		O
17	Ammonium bifluoride	O		O
18	Ammonium carbonate	O		O
19	Ammonium chloride	O		O
20	Ammonium diphosphate	O		O
21	Ammonium fluoride	O		O
22	Ammonium hydroxide	O		O
23	Amylacetate	O		O
24	Amyl alcohol	O		O
25	Aniline	O	X	O
26	Anone (Cyclohexanon)	O		O
27	Aqua regia	X		O
28	Barium salt, aqueous	O	O	O



NO	Media	Graphite	Non-Asb.	PTFE
29	Bariumchloride	O		O
30	Benzene	O	B	O
31	Benzoic acid	O	B	O
32	Benzol	O		O
33	Benzylchloride	O		B
34	Black liquor (sulfide)	O		O
35	Black liquor (sulphate)	O		O
36	Bleach liquor (dry)	O		O
37	Borate (aqueous solution)	O		O
38	Boric acid	O		O
39	Boric hydrogen fluoride	X		O
40	Bromic trifluoride	X		X
41	Bromine, liquor	X		O
42	Butadiene	O		O
43	Butane	O	O	B
44	Butanol (Butyl alcohol)	O	O	O
45	Butanone (Methyl ethylketone)	O		O
46	Butyl acetate	O	B	O
47	Butyl amine	O		O
48	Butylphenol	O		O
49	Butyric acid	O	O	O
50	Calcium chloride	O	O	O
51	Calcium hydroxide	O	O	O
52	Calcium hypochloride	O		O
53	Calcium oxide	O		O
54	Calcium sulphate	O	O	O
55	Carbamide	O		O
56	Carbolic acid (Phenol)	O	X	O
57	Carbon bisulphate	O	X	O
58	Carbon dioxide	O	O	O
59	Carbon hydrate	O		O
60	Carbon tetrachloride	O	B	O
61	Caustic potash solution liquor	O		O
62	Caustic soda	O	X	O
63	Cesium melt			X
64	Chlorine	X		O
65	Chlorine (dry)	O	B	O

NO	Media	Graphite	Non-Asb.	PTFE
66	Chlorine bleach liquor	O	X	O
67	Chlorine trifluoride	X		X
68	Chlorine water solution	X		O
69	Chlorobenzene	O		O
70	Chlorodioxide	X		O
71	Chloroform (trichloromethane)	O	B	O
72	Chromic acid	O	B	O
73	Chroming solutions	B		O
74	Clophen	O		O
75	Copper sulphate	O	O	O
76	Cresol	O	B	O
77	Cyclohexane	O	O	O
78	Cyclohexanol	O		O
79	Decalin	O		O
80	Dibenzylether	O	X	O
81	Dibutylphthalate	O		O
82	Dichlorien methan (Methylenchloride)	O		B
83	Diesel oil	O	O	O
84	Diethylketone	O		O
85	Dimethylamine	O		O
86	Dimethylformamide	O	X	O
87	Dioxane	O	X	O
88	Diphenyl	O		O
89	Dithiophosphoric acid	O		O
90	Ethane	O	O	O
91	Ethanoic acid / pure acetic acid	O		O
92	Ethanol (Ethyl alcohol)	O	O	O
93	Ethyl acetate	O	B	O
94	Ethylchloride	O	X	O
95	Ethylendiamine	O		O
96	Ethylene	O		O
97	Ethylene oxide	O		X
98	Ethylenglycol	O	O	O
99	Ethylenoxide	O		X
100	Ethylether	O	O	O
101	Fatty alcohols	O		O
102	Fluorine benzene	O		O

NO	Media	Graphite	Non-Asb.	PTFE
103	Fluorine dioxide	X		X
104	Fluorine hydrogen chloride	O		B
105	Fluorine, gaseous	B		X
106	Fluorine, liquor	X		X
107	Fluoro carbon	O		O
108	Fluorosilicic (HF)			O
109	Fluosilic acid	O		O
110	Formaldehyde (Methanal, Formaline)	O	O	O
111	Formamide	O		O
112	Formic acid	O	X	O
113	Glycerine	O	O	O
114	Glycol (Ethylene glycol)	O		O
115	Heptane	O	O	O
116	Hexamine (Urotropin)	O		
117	Hydraulic oil	O		O
118	Hydrazine	O		O
119	Hydrazine hydrate	O		O
120	Hydrochloric acid	O	X	O
121	Hydrocyanic acid	O		O
122	Hydrofluoric acid, 40%	O		O
123	Hydrofluorsilicic			O
124	Hydrogen chloride	O		O
125	Hydrogen fluoride	O		O
126	Hydrogen peroxide	B	X	O
127	Hydrogen sulphide	O		O
128	Hydrosilicic fluoric acid	O		O
129	Hydrosilico fluoride	O		O
130	Iod	O		O
131	Isooctane	O	O	O
132	Isopropanol (Isopropylalcohol)	O	O	O
133	Kerosene	O		O
134	Kerosine	O		O
135	Ketone	O		O
136	Lactic acid	O	O	O
137	Lauryl alcohol	O		O
138	Lead acetate	O		O
139	Lead arsenate	O		O

NO	Media	Graphite	Non-Asb.	PTFE
140	Line water	O	O	O
141	Lithium bromide	O		O
142	Lithium melt			X
143	Magnesium hydroxide	O		O
144	Magnesium sulphate	O	O	O
145	Maleic acid	O		O
146	Maleic acid hydride	O		O
147	Methane	O		O
148	Methanol (Methylalcohol)	O	O	O
149	Mineral oil	O		O
150	Monochlor methane (Methylchloride)	O		O
151	Monochloracetic acid	O		O
152	Morpholine	O		O
153	Naphta	O	B	O
154	Naphtalene	O		O
155	Natural gas type L	O		O
156	Nitric acid	B	X	O
157	Nitrobenzene	O	X	O
158	Ocalic acid	O		O
159	Octane	O	O	O
160	Oelic acid	O	O	O
161	Oil	O		O
162	Oleum (fuming nitric acid)	X	X	X
163	Oxygen up to ca. 350	O		O
164	Palmitic acid	O	O	O
165	p-Dihydroxybenzene (hydroquinone)	O		O
166	Pentane	O		O
167	Perchloric acid	B		O
168	Perchloroethylene	O	B	O
169	Petroleum ether	O	O	O
170	Phenol	O	X	O
171	Phosgene	O		O
172	Phosphorous acid 20%	O		O
173	Phosphorous acid, >45%	O		O
174	Phosphorous, impure	O		O
175	Phthalic acid	O		O
176	Potassium acetate	O		O

NO	Media	Graphite	Non-Asb.	PTFE
177	Potassium bifluorine, saturated	O		O
178	Potassium carbonate	O	O	O
179	Potassium chlorate	X	O	O
180	Potassium chloride	O	O	O
181	Potassium chromate	B		O
182	Potassium chrome sulphate			O
183	Potassium cyanide (Cyankali)	O		O
184	Potassium hydroxide (caustic potash solution)	O	B	O
185	Potassium hypochloride	O		O
186	Potassium iodide	O	O	O
187	Potassium melt up to 350 ;ÆC	O		X
188	Potassium nitrate	X	O	O
189	Potassium nitrate (melt)	X		X
190	Potassium permanganate	O		O
191	Potassium silicate	O		O
192	Propane	O	O	O
193	Pyridine	O	X	O
194	Salicylic acid	O		O
195	Soda	O	O	O
196	Sodium acetate	O		O
197	Sodium aluminate	O	O	O
198	Sodium aluminium fluoride / Kryolith	O		O
199	Sodium ammonium hydrogen phosphate	O		O
200	Sodium bisulphate	O	O	O
201	Sodium carbonate	O	O	O
202	Sodium chloride	O		O
203	Sodium cyanide	O		O
204	Sodium hydrate (caustic soda)	O	X	O
205	Sodium hypochloride	O		O
206	Sodium melt up to 350 ;ÆC	O		X
207	Sodium phosphate, bi-basic	O		O
208	Sodium phosphate, tribasic	O		O
209	Sodium silicate	O		O
210	Sodium silicate (water glas)	O	O	O
211	Sodium sulfide	O	O	O
212	Sodium sulphate	O	O	O
213	Stearic acid	O		O

NO	Media	Graphite	Non-Asb.	PTFE
214	Styrene	O		X
215	Sulphur dioxide	O	X	O
216	Sulphur trioxide	X		O
217	Sulphuric acid over 70% Up to 100jÆC	Up to 100		O
218	Sulphuric acid up to 70%	O	X	O
219	Sulphuric acid, 75-98%, 65-260°C Up to 100°C	Up to 100		O
220	Sulphuric acid, fuming (Oleum)	X	X	O
221	Sulphurous acid	O	B	O
222	Tannic acid	O	O	O
223	Tannin	O		O
224	Tetrachloroethane	O	X	O
225	Tetrafluor boric acid (HF)	O		O
226	Tetraline (1,2,3,4 Tetra hydronaphtaline)	O		O
227	Toluene	O	B	O
228	Tribasic calcium	O		O
229	Trichloroethylene	O		O
230	Trichlorotrifluorethane (F 113)	O		B
231	Triethanolamine	O		O
232	Triethylene aluminium	O		X
233	Triethylene tetramine	O		O
234	Trisodium phosphate	O		O
235	Turpentine	O		O
236	Vinyl chloride	O		O