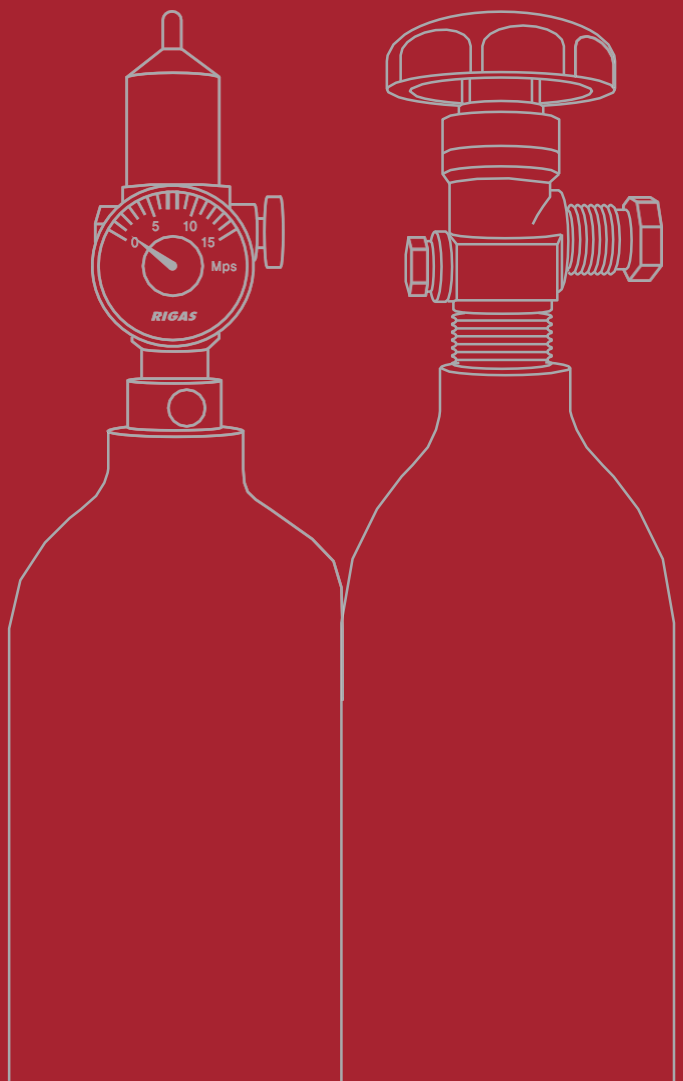
www.rigas.co.kr

rigas | ONE

Calibration Gases



- Compact(1L size)
- High pressure
- Non-reactive gas
- Reactive gas
- PAMS
- TO-14A

RIGAS 리가스
Research Institute of Gas Analytical Science

Company Information

A Company specialized in Production, Analysis and Research of Standard Materials

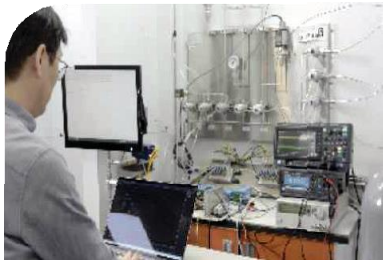
RIGAS Co., Ltd manufactures all standard gases in gravimetric method using high precision and high capacity scale. We guarantee the accuracy for the concentration of every component by quantifying and verifying with various gas analyzers.

A company manufacturing variety of Standard Materials

RIGAS Co., Ltd provides standard gases in various specifications that customers need.

Approvals

- Appointed as a government-authorized standard gas testing and certification agency by Korea National Institute of Environmental Research
- KS Q ISO 9001 certification
- KS A ISO 17034



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rigas | ONE developed by RIGAS Co., Ltd is a compact high pressure standard gas.
It is made to be easy to use anywhere at anytime. RIGAS provides customers with the various components and concentrations needed for the calibration and so on.

Special features

- The quality and safety of cylinders and valves are guaranteed as certified products of DOT and KGS(Korea Gas Safety Corporation).
- All products are provided to customers with certificate of analysis.
- All products are traceable through international standard institution.
- We will supply customers with the pressure you want and it can be refilled up to 10 MPa.

Traceability

Our analytical operations are traceable through a calibration standard produced to either a recognized international standard such as KRISS, NIST, VSL, NPL, or a gravimetrically manufactured reference standard traceable to KRISS 1. WT CLASS standard masses.

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RIGAS CO. LTD.'s small 1L standard gas tanks are refillable high-pressure cylinders available in two models, R1 and R2. Each standard cylinder offers high stability, confirmed according to composition and concentration standards. The detailed characteristics of R1 and R2 cylinders are as follows:

R1

The cylinders offer improved compatibility and convenience with regular small valves and are suitable for non-reactive components and exhaust gas of automobile.

Components of R1			
Non-reactive component, O2, CO, CO2, N2, exhaust gas of automobile, etc.			
Cylinder			
Size	1.0 L (D 8.1cm, H 33cm) * Size including the valve	Weight	0.98 kg * Weight including the valve
Material	Aluminum	Pressure	7.0 MPa or less
Valve			
Body	Ni plated Brass	Connection	5/8-18 UNF thread

R2

With enhanced stability for product concentration and special chemical treatment, they are suitable for reactive or adsorptive components.

Components of R2			
Reactive component, PAMS, TO-14A, All components serving in R1			
Cylinder			
Size	1.1 L (D 8.1cm, H 38cm) * Size including the valve	Weight	1.4 kg * Weight including the valve
Material	Aluminum	Pressure	10 MPa or less
Valve			
Body	SUS	Connection	CGA-180

Product Information

Standard gas available

- Atmospheric Environmental Calibration Standards
- Petrochemical and Natural Gas Standards
- Odor Standards
- Toxic Gas Mixtures
- PAMS (Ozone Precursor)
- Automobile Exhaust Gas Standards
- Laser Gas Mixtures
- Volatile Organic Compound Standards (VOCs)
- Other Gas Mixtures
- TO-14A (Toxic Organics)

Pure gas - Provides R1, R2

Components	Concentration (cmol/mol)
N_2	99.999 / 99.999 9
Air	Air / zero-Air / UHP-Air

Non-reactive gas - Provides R1, R2

Components	Concentration (cmol/mol)	Balance	Urel.*
H_2	2.00	Air	2
O_2	2.00 ~ 20.9	N_2	2
iso-C_4H_8	0.01	Air	2
CO_2	0.03 ~ 20	N_2 / Air	2

※ If you have any inquiry on products and mixing besides the above components and concentration, ask for consultation and we will provide further information.
E-mail : master@rigas.co.kr (Domestic-Korea), sales@rigas.co.kr (Overseas)

※ Urel : relative expanded uncertainty

* Each standard cylinder offers high stability, confirmed according to composition and concentration standards.

Product Information

Reactive gas (single component) - Provides R2

Components	Concentration (cmol/mol)	Balance	Urel.*
NO	0.001	N_2	3
SO_2	0.001	N_2	3
CO	0.001	N_2	3
H_2S	0.002 ~ 0.005	N_2 / Air	< 3
NH_3	0.002 ~ 0.010	N_2	< 3
HCl	0.001	N_2	3
HCN	0.001	N_2	5
Cl_2	0.000 5 ~ 0.001	N_2	5
C_2H_5OH	0.1 ~ 0.2	Air	2
PH_3	0.000 06	N_2	10
NO_2	0.005	N_2	2
SiH_4	0.001	N_2	5
C_2H_4O	0.030	N_2	3

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※ Urel : relative expanded uncertainty

* Each standard cylinder offers high stability, confirmed according to composition and concentration standards.

Product Information

Reactive gas (multi components) - Provides R2

Components	Concentration (cmol/mol)	Balance	Urel.*
H_2S	0.001~0.005	N_2	< 5
CO	0.005~0.05		2
CH_4	1.5~2.5		2
O_2	15~19		2
CH_3SH	0.001	N_2	5
H_2S	0.001		5
DMS	0.001	N_2	5
DMDS	0.001		5

Automobile Exhaust Gas - Provides R1, R2

Components	Concentration (cmol/mol)	Balance	Urel.*
CH_4	2.5	N_2 / Air	2
iso-C_4H10	0.9	N_2 / Air	2
CO_2	14	N_2	2
C_3H_8	0.2		
CO	1		
O_2	1		

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PAMS, TO-14A

PAMS 57 Components mix (Ozone Precursor) - Provides R2

VOCs measured by the Photochemical Assessment and Measurement Station (PAMS) as precursors contributing to ozone generation

TO-14A 43 Components mix (Toxic Organics) - Provides R2

VOCs according to the US Environmental Protection Agency (EPA) standards as hazardous air pollutants in the atmosphere

Special features

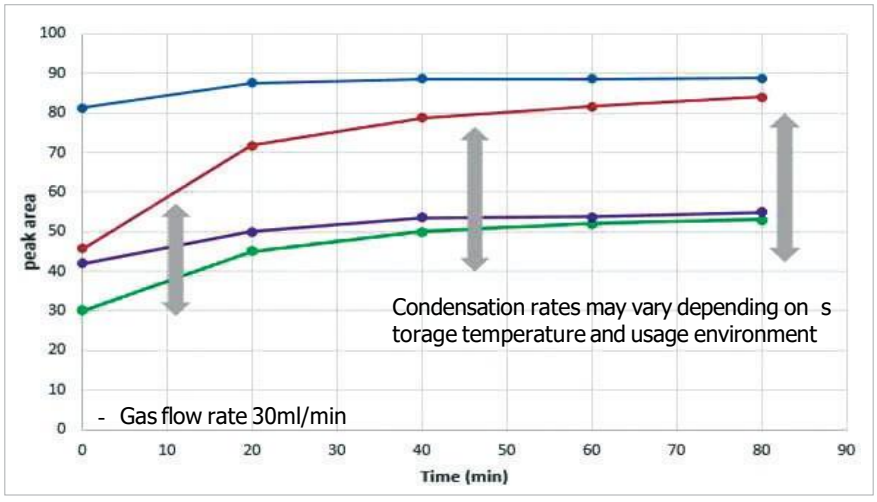
- Highly convenient and portable small 1L container (R2)
- Highly reliable values proven through short-term/long-term stability assessment
- KS I ISO 6142: Manufactured in accordance with 2015 standards (Gas analysis-Production of calibration gas mixture-Gravimetric method)
- Cylinders with special internal treatment
- Validity period of 12 months
- Precise measurement of components with low-vapor pressure and additional cylinder heating/regulator heating devices

Product information

	Concentration	Balance	Specification
PAMS	5 nmol/mol	N_2	Blend tolerance: ± 30 % ; Analytical accuracy: ± 20 %
	1 μmol/mol	N_2	Blend tolerance: ± 10 % ; Analytical accuracy: ± 5 %
TO-14A	10 nmol/mol	N_2	Blend tolerance: ± 20 % ; Analytical accuracy: ± 10 %
	1 μmol/mol	N_2	Blend tolerance: ± 10 % ; Analytical accuracy: ± 5 %

Analytical Tips

- Some of the components with the low-vapor pressure in PAMS and TO-14A are gradually condensed in cylinders depending on time elapsed, storage temperature, and usage environment after manufacturing. As a result of it, lower concentration may be detected. Cylinder heating systems provided by RIGAS will help you to use those components at the correct concentration.
- Components with low-vapor pressure or strong adsorption may be adsorbed during the analysis process. It will cause difficulty to detect accurate concentration. With regulator heating systems provided by RIGAS, the concentration stabilization time of the components can be shorten and ensure accurate figures.
- Comparison of the peak size of n-Dodecane 1 μmol/mol in PAMS by time (3 months after manufacturing)



[Cylinder Heating Device]

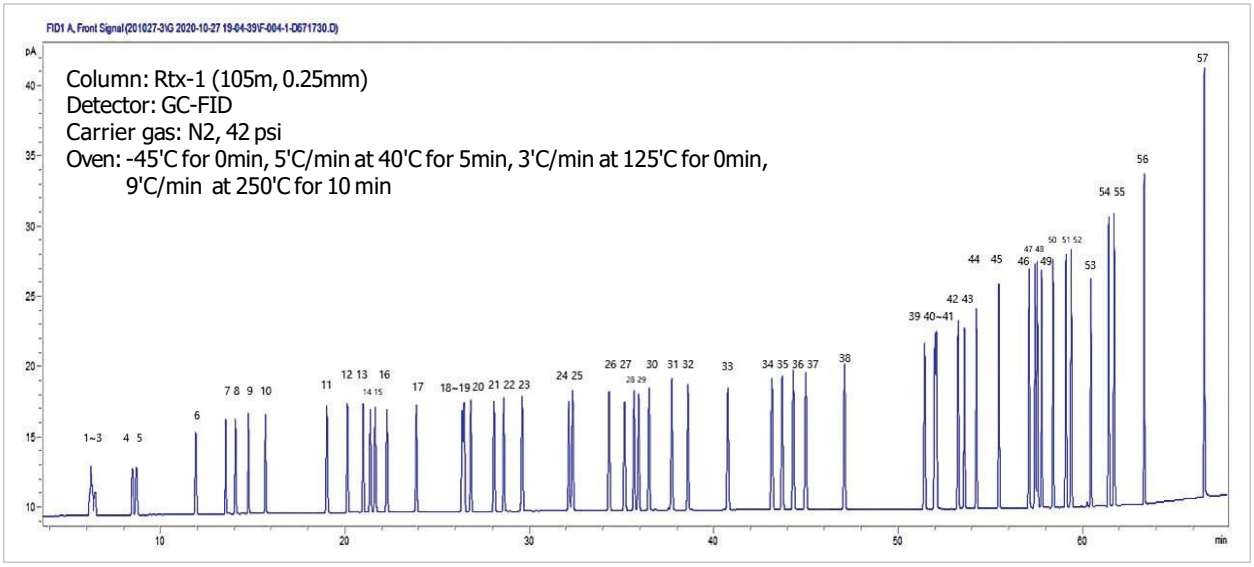
	Cylinder Heating Device	Regulator Heating Device	Result
—	Y	Y	Normal level
—	Y	N	90 % of normal level
—	N	Y	50 % less than normal
—	N	N	50 % less than normal

[Regulator Heating Device]

RIGAS supplies cylinder heating and regulator heating devices for precise component concentration analysis.

PAMS 57 Components mix (Ozone Precursor)

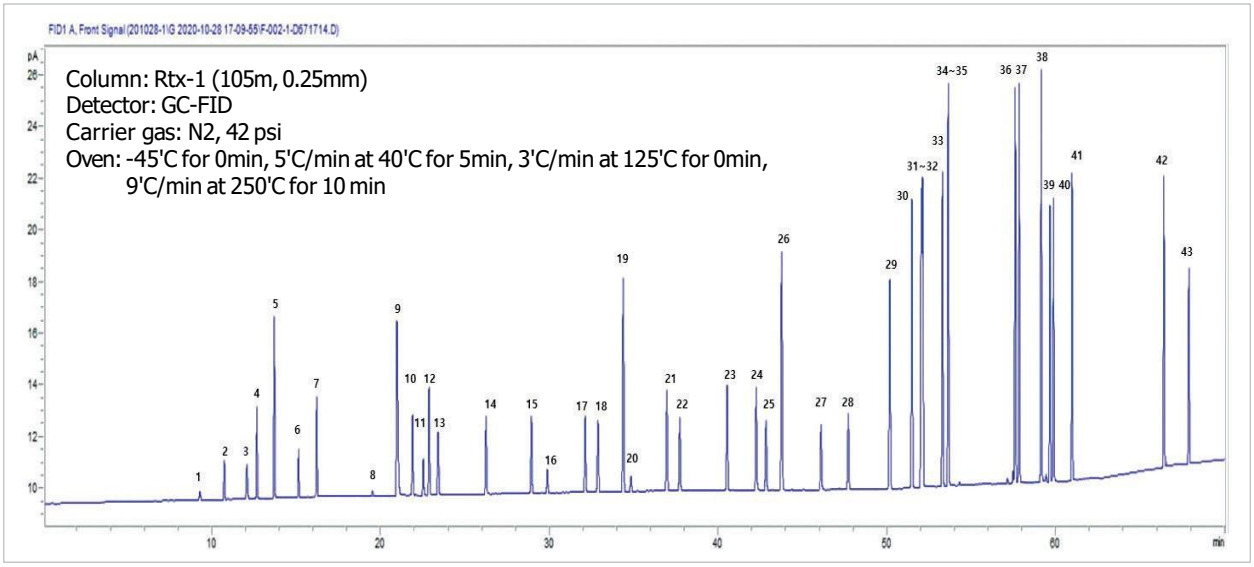
Chromatogram & components



1	Ethylene	20	2-Methylpentane	39	Ethylbenzene
2	Acetylene	21	3-Methylpentane	40	m-Xylene
3	Ethane	22	1-Hexene	41	p-Xylene
4	Propylene	23	n-Hexane	42	Styrene
5	Propane	24	Methylcyclopentane	43	o-Xylene
6	Isobutane	25	2,4-Dimethylpentane	44	n-Nonane
7	1-Butene	26	Benzene	45	Isopropylbenzene
8	n-Butane	27	Cyclohexane	46	n-Propylbenzene
9	trans-2-Butene	28	2-Methylhexane	47	m-Ethyltoluene
10	cis-2-Butene	29	2,3-Dimethylpentane	48	p-Ethyltoluene
11	Isopentane	30	3-Methylhexane	49	1,3,5-Trimethylbenzene
12	1-Pentene	31	2,2,4-Trimethylpentane	50	o-Ethyltoluene
13	n-Pentane	32	n-Heptane	51	1,2,4-Trimethylbenzene
14	Isoprene	33	Methylcyclohexane	52	n-Decane
15	trans-2-Pentene	34	2,3,4-Trimethylpentane	53	1,2,3-Trimethylbenzene
16	cis-2-Pentene	35	Toluene	54	m-Diethylbenzene
17	2,2-Dimethylbutane	36	2-Methylheptane	55	p-Diethylbenzene
18	Cyclopentane	37	3-Methylheptane	56	n-Undecane
19	2,3-Dimethylbutane	38	n-Octane	57	n-Dodecane

TO-14A 43 Components mix (Toxic Organics)

Chromatogram & components



1	Dichlorodifluoromethane	20	Carbon Tetrachloride	39	1,3-Dichlorobenzene
2	Chloromethane	21	1,2-Dichloropropane	40	1,4-Dichlorobenzene
3	Freon-114	22	Trichloroethylene	41	1,2-Dichlorobenzene
4	Vinyl Chloride	23	cis-1,3-Dichloropropene	42	1,2,4-Trichlorobenzene
5	1,3-Butadiene	24	trans-1,3-Dichloropropene	43	Hexachloro-1,3-Butadiene
6	Bromomethane	25	1,1,2-Trichloroethane		
7	Chloroethane	26	Toluene		
8	Freon-11	27	1,2-Dibromoethane		
9	Acr ylonitrile	28	Tetrachloroethylene		
10	1,1-Dichloroethene	29	Chlorobenzene		
11	Methylene Chloride	30	Ethylbenzene		
12	3-Chloropropene	31	p-Xylene		
13	Freon-113	32	m-Xylene		
14	1,1-Dichloroethane	33	Styrene		
15	cis-1,2-Dichloroethylene	34	o-Xylene		
16	Chloroform	35	1,1,2,2-Tetrachloroethane		
17	1,2-Dichloroethane	36	4-Ethyltoluene		
18	1,1,1-Trichloroethane	37	1,3,5-Trimethylbenzene		
19	Benzene	38	1,2,4-Trimethylbenzene		

RIGAS 리가스

Research Institute of Gas Analytical Science

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