NIPPON SANSO

Specialty Gas solutions



Nippon Sanso Belgium N.V.
info.belgium@eu.nipponsanso.com

Schoten
Metropoolstraat 17
2900 Schoten
Belgium
+32 3 641 84 50

Olen
Lammerdries-Oost 29
2250 Olen
Belgium
+32 14 250 411

Naninne
Rue des Pieds D'Alouette 44
5100 Naninne
Belgium
+32 81 40 16 01

Oevel
Nijverheidsstraat 4
2260 Westerlo
Belgium
+32 14 250 611

Zwijndrecht
Scheldedijk 58 - Haven 1013
2070 Zwijndrecht
Belgium
+32 3 252 02 11

Nippon Sanso Netherlands B.V.
info.netherlands@eu.nipponsanso.com

Vlaardingen
Beugsloepweg 3
3133 KV Vlaardingen
Netherlands
+31 10 434 04 55

Enschede
Twekkeler-Es 8
7547 SM Enschede
Netherlands
+31 53 430 72 32

Nippon Sanso Europe
info@eu.nipponsanso.com

Calle Orense 11
28020 Madrid
Spain

Taiyo Nippon Sanso Corporation

1-3-26 Koyama, Shinagawa-Ku
142-8558 Tokyo
Japan

www.tn-sanso.co.jp/en

Copyright 2026, Nippon Sanso Belgium NV. All rights reserved. eu.nipponsanso.com
The information contained herein is offered for use by technically qualified personnel at their discretion and risk without warranty of any kind.

Index

Introduction	5
Specialty Gas solutions	6
Quality and safety	8
High purity gases	9
Calibration mixtures	12
Helium	22
Electronic gases and mixtures	23
Process gases	25
Food packaging	26
Equipment for Specialty Gases	27
Technical data	29



Nippon Sanso

Introduction
Know-how and development in Specialty Gases

A global company

Nippon Sanso is part of the Nippon Sanso Holdings Group, a global Group with more than 100 years of experience, a presence in over 30 countries and nearly 20,000 employees worldwide, the group combines global reach with local expertise.

The Company has built a broad business portfolio encompassing a diverse range of industrial gases, as well as related equipment, facilities and technologies, worthy of its corporate slogan, "**The Gas Professionals**", through which it has contributed to the advancement of both industry and humanity.

Nippon Sanso in Europe

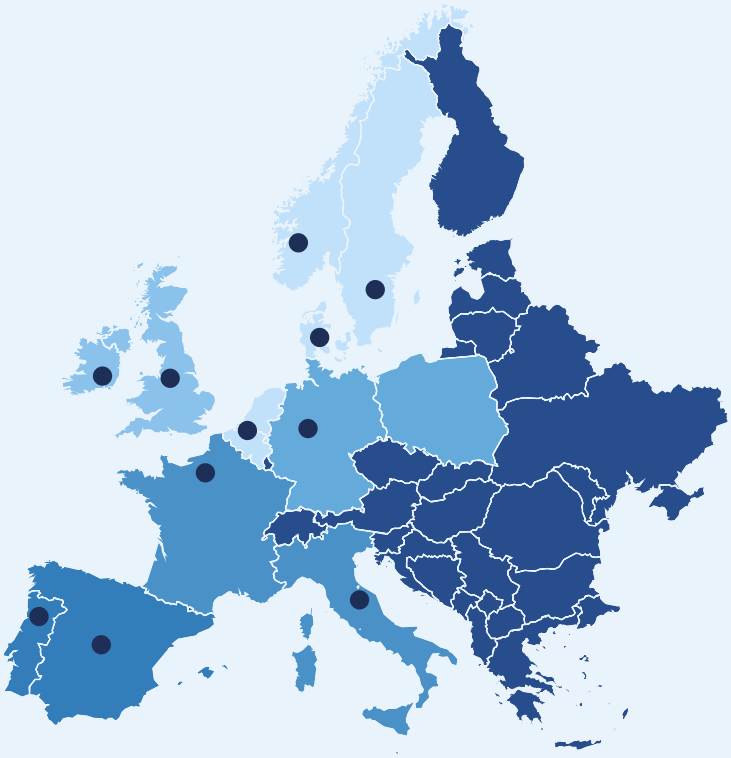
Nippon Sanso is a leading industrial and medical gases company in Europe, present in 13 different countries in Europe, namely Belgium, Denmark, France, Germany, Ireland, Italy, The Netherlands, Norway, Poland, Portugal, Spain, Sweden and the UK. With 4.000 employees and more than a billion dollar turnover, the company is one of the fourth largest Industrial gas companies in Europe.

Our products and services include:
- Liquid bulk production and supply (Nitrogen, Oxygen and Argon) by pipeline and trailer shipments
- On site Nitrogen plants
- On site membrane (N_2) and VPSA (O_2) units
- Specialty, Electronic and Industrial gases in cylinders

In addition, we keep on improving our products and services to offer a cost-efficient production and a service to meet customers' needs.

Main Office

- Around 4.000 employees
- Over 150.000 customers
- 14 pipelines
- 7 Specialty Gases laboratories
- 31 Air Separation Units
- 6 hydrogen plants
- 52 small On-Site
- 14 CO_2 plants
- 1K trucks
- 2.9 million cylinders
- 40 filling stations
- 19 dry Ice plants
- 7 CO_2 terminals
- 3 CO_2 ships



Specialty Gas solutions
Our products and services

Competence Centres Specialty Gases

In addition to being one of the leading manufacturers of industrial gases, Nippon Sanso also has over 40 years of experience in Specialty Gases' production, packaging and servicing.

Nippon Sanso's gases can be used in a wide range of industries and applications, such as: Chemical, Petrochemical, Pharmacy and Biotechnology, Environmental control and monitoring, Universities, Industrial and Governmental Research, Semiconductor and Photovoltaic processing, Glass Manufacturing, Lighting, Automotive Industry Food&Beverage and much more.

Nippon Sanso can offer complete solutions tailored to customers' needs in Industrial, Electronic and Specialty Gases and associated equipment.

A virtual tour

Nippon Sanso's largest Specialty Gas plant in Europe is located in Oevel, Belgium. The plant counts more than 80 experienced employees and dedicated production units for Helium, high purity gases, semiconductor and photovoltaic processing gases and mixtures, rare gases and a wide range of calibration mixtures.

Nippon Sanso also has specific Specialty Gases plants in other European countries. Thanks to the Group's R&D centers in Japan and the USA and a global network of specialists, Nippon Sanso stays close to customer's needs with adequate application development.













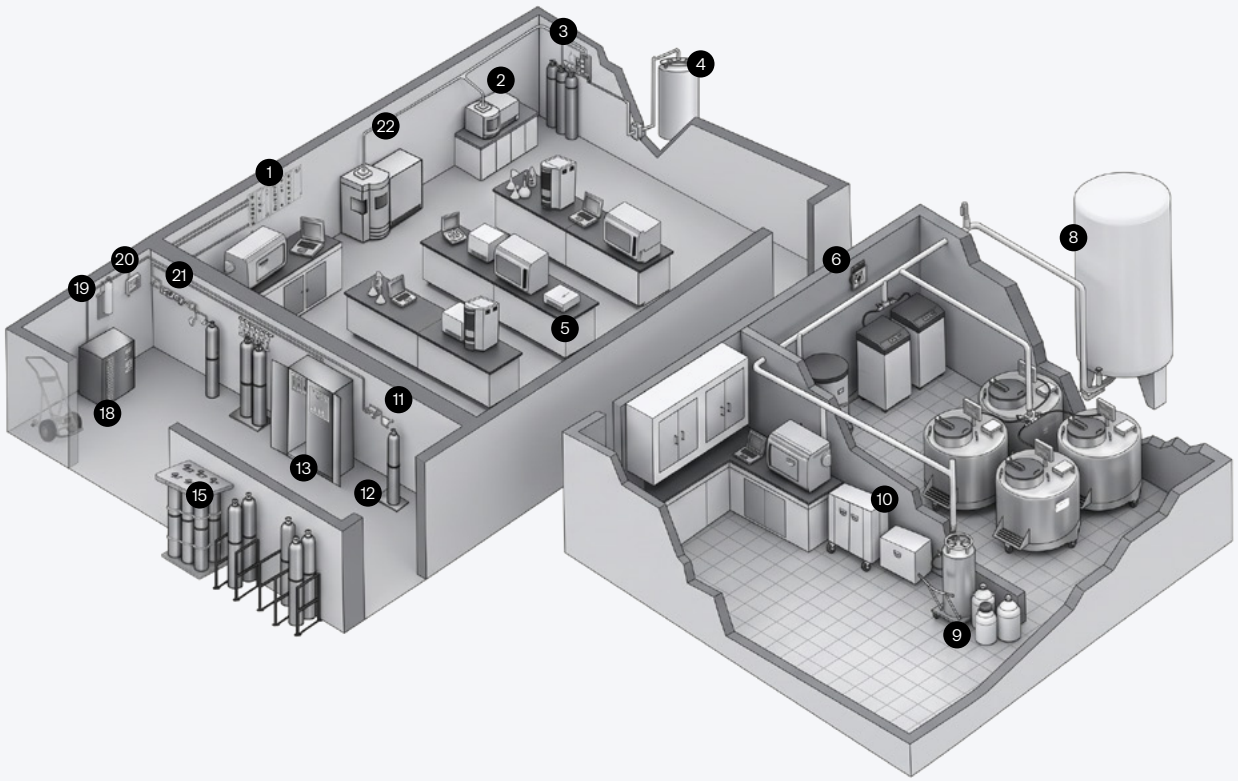
(1) European Electronics Processing Innovation Center
(2) Analytical certification of Calibration Mixtures and product Quality Control
(3) Accurate preparation of Calibration Mixtures (Quickfill™)
(4) Production center of high purity Semiconductor Process gases
(5) Liquid- and gaseous Helium processing center for cylinders, bundles, dewars and tube trailers
(6) Purification, Quality Control and storage of high purity compressed gases

This scheme highlights the many solutions for different applications in a laboratory environment.

Analytical laboratory
1. Point-of-use panels
2. Gas generators (H_2, Air, N_2)
3. Cylinder Switch-over systems
4. Microbulk to replace cylinder bundles
5. Mass flow controllers

Gas storage and supply
6. O_2 deficiency monitors
7. Vacuum isolated piping
8. Bulk storage tanks for liquid Nitrogen, Oxygen and Argon
9. Transportable dewars for liquid Nitrogen or liquid Helium
10. Dry ice containers

Cylinder management
11. CO_2 heating elements
12. Electronic weighing scales
13. Gas cabinets
14. Cylinder storage areas
15. Cylinder bundles
16. Gas distribution panels
17. Cylinder trolley
18. Air generator or compressor
19. N_2 Membrane generator
20. Fixed detection system
21. Gas purifiers
22. Installation and testing of high quality gas tubing



Quality and safety
Not just a label but a tradition of excellence

Leading in safety

Safety is one of Nippon Sanso's main principles. Safety starts with the company's own suppliers, continues in the plants through to the safe application of Specialty Gases at customers' sites.

The potentially hazardous properties of Specialty Gases, such as pressure, flammability, toxicity and corrosiveness, require handling with total safety consciousness. This consciousness can be achieved through training, know-how, skilled resources and personal commitment.

Quality

Cylinder preparation, analytical capabilities and qualitative laboratory practices are key elements in the production of Specialty Gases.

In 1992, Nippon Sanso was the first to obtain the ISO 9000 certification for the production and sales of Industrial and Specialty gases in Belgium, France and Spain. Since the company has obtained, kept and extended the following certifications:

- ISO 14001
- ISO 9001
- ISO17025 - Calibration Level



High purity gases
Basis of your day to day analytical work

High purity gases for analytical applications

Nippon Sanso's gases are offered in different purities and packaging sizes. From a standard 50 liter high pressure cylinder to the larger 600 liter water capacity. In addition, the company offers Argon, Nitrogen, Helium and Oxygen in 300 bar packages for the larger cylinder capacities.

The company also offers smaller sizes of 3 and 10 liter water capacity for users requiring a smaller amount of product or those who have limited access or storage dimensions.



High purity laboratory instrument gases

Purity specifications (ppm max.)									Package types & content at 21°C 200 bar (except CO_2 = 57bar)				
Gas	Quality (% min)	H_2O	O_2	T.H.C. (as CH_4)	CO_2	CO	H_2	N_2	600H	50H	10H	3H	Connection B= Belgium D= Germany NL= Netherlands F= France
Argon	99.999	< 3	< 2	< 0.2	-	–	< 1	< 5	132 m³	11 m³	2.2 m³	0.43 m³	B: DIN477-N°6 D: DIN477-N°6 NL: DIN477-N°10 (RU3) F: Raccord NF-Type C
	99.9997	< 1	< 0.5	< 0.1	< 0.1	< 0.1	< 0.1	< 1					
	99.9999	< 0.5	< 0.2	< 0.05	< 0.05	< 0.05	< 0.1	< 0.5					
Carbon dioxide	99.996	< 10	< 5	< 5	–	–	–	< 20	-	37.5 Kg	7.5 Kg	2 Kg	B: DIN477-N°6 D: DIN477-N°6 NL: DIN477-N°6 (RU1) F: Raccord NF-Type C
	99.999	< 5	< 2	< 2	–	< 1	< 1	< 10					
Helium	99.999	< 3	< 2	< 0.1	–	–	< 1	< 5	111.6 m³	9.3 m³	1.8 m³	0.38 m³	B: DIN477-N°6 D: DIN477-N°6 NL: DIN477-N°10 (RU3) F: Raccord NF-Type C
	99.9996	< 2	< 0.5	< 0.1	< 0.2		< 0.1	< 2					
	99.9999	< 0.5	< 0.2	< 0.05	< 0.1		< 0.1	< 0.5					
Hydrogen	99.999	< 3	< 2	< 0.1	–	–	–	< 5	109.2 m³	9.1 m³	1.8 m³	0.37 m³	B: DIN477-N°1 D: DIN477-N°1 NL: DIN477-N°1 (LU1) F: Raccord NF-Type E
	99.9996	< 2	< 0.5	< 0.1	< 0.1	< 0.1	–	< 2					
	99.9999	< 0.5	< 0.2	< 0.05	< 0.05	< 0.05	–	< 0.5					
Nitrogen	99.999	< 3	< 1	< 0.2	–	–	< 1	–	120 m³	10 m³	2 m³	0.4 m³	B: DIN477-N°6 D: DIN477-N°10 NL: DIN477-N°10 (RU3) F: Raccord NF-Type C
	99.9996	< 2	< 0.5	< 0.1	< 0.1	< 0.1	< 0.1	–					
	99.9999	< 0.5	< 0.2	< 0.05	< 0.05	< 0.05	< 0.1	–					
Oxygen	99.999	< 3	–	< 0.1	< 0.5	< 0.5	–	< 5	132 m³	11 m³	2.2 m³	0.44 m³	B: G5/8 D: DIN477-N°9 NL: Ri2 F: Raccord NF-Type F
	99.9999	< 0.5	–	< 0.02	< 0.1	< 0.2	–	< 1					
Synthetic air (21% O_2 +/- 1%)	99.995	< 5	–	< 0.1	< 0.5	–	–	NOx < 0.1	122.4 m³	10.2 m³	2 m³	0.41 m³	B: DIN477-N°6 D: DIN477-N°9 NL: RU6 F: Raccord NF-Type C
	99.999	< 2	–	< 0.1	< 0.2	< 1	< 0.5	NOx < 0.1					
	99.9997	< 0.5	–	< 0.05	< 0.1		< 0.1	NOx < 0.02					

High purity gases

Gases for other applications

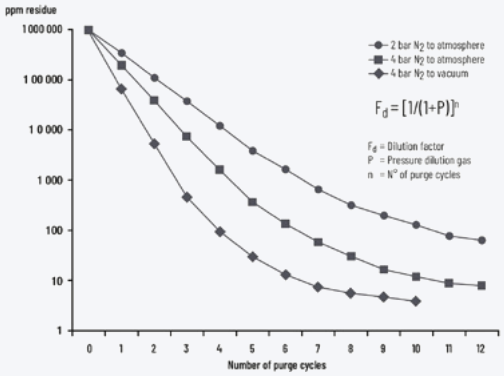
In certain applications, like toxic and corrosive gas handling systems, Nippon Sanso always recommends purging of the cylinder connection area with an external, inert and moisture free assist gas, preferrably Nitrogen 6.0 (99.9999% purity). This method is called “Dilution purging” and is highly preferred above the traditional “Flush-through purging” methods. The graphs represent the difference.

Pressurising liquid phase mixtures, liquids or liquified gases which have a very low vapour pressure, can be realised by a blanket of an inert gas, such as Helium, Argon and Nitrogen. It facilitates withdrawal of the liquid phase from the package.

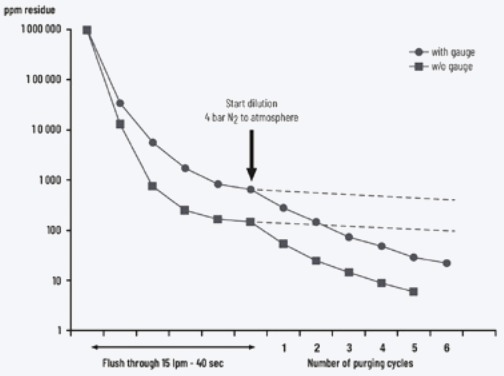
Solubility of this assist gas into the liquid phase may cause errors in certain analytical applications, for example when applying response factors. In such cases, Helium is preferred over Nitrogen or Argon because it has a lower solubility. (See graph).

Oxygen is used for Combustion analysers and Calorimeters. This gas is available up to a high purity of 6.0 (99.9999%).

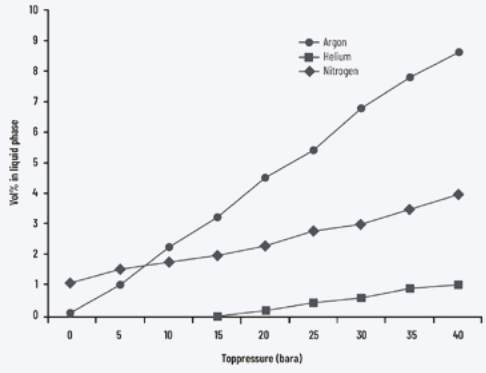
Purging: dilution



Purging: flush through - dilution



Solubility of headspace gases in liquid phase



By using pure Krypton and Argon, high performance **thermal window** insulation is obtained.

More complex mixtures of Xenon and Krypton are also used in advanced **lighting technologies** for domestic, medical instruments and automotive use. In addition, Xenon is also used in **space technology** as a propulsion medium for satellite ion engines.

(1) Argon and Krypton for increased thermal insulation of double or triple window glass
(2) Krypton and Xenon used in production of lamps for automotive lighting
(3,4) Xenon used as propulsion medium in plasma satellite engines









Calibration mixtures
Decades of experience

Let it work for you

Process quality control, safety monitoring and environmental compliances are all subject to analytical measurements. That's why the expression "measuring is knowing" has gained importance in Industry and Research.

These measurements can be imposed by governmental or EU regulations as well as by company rules and Codes of Practice. As such, they are an important part of quality systems. Calibration Mixtures, to calibrate analytical equipment, play a crucial role in the correctness and reliability of measurement results.

Nippon Sanso has gained a long term experience and know-how in the production and certification of consistently stable and accurate calibration mixtures in a wide variety of accuracies and traceabilities.

A grasp of the many applications for calibration mixtures

Environmental analysis (1)
Immision and (Stack) emission control mixtures.

Laboratory analysis (2)
Verification of process samples, research and development.

Chemical and petrochemical process monitoring (3)
Hydrocarbon cracker compositions, Furnaces exhaust control, Safety- and explosion risk monitoring.

Natural gas analysis
Calorific value determination (Wobbe-Index)
Sulphur content control.

Laser applications
Assist mixtures for cutting, marking and welding lasers.

Medical monitoring applications
Blood gas monitoring and aerobic and anaerobic culture growth.

Detector testing and calibration
Toxic gas and explosion, risk monitoring.

Lighting
Publicity lighting displays and lamps.

Car exhaust control
Control of CO_2 emissions and catalyst performance.

Engine testing
Control of maximum emissions according to EU and EPA regulations.







Key aspects for consistent quality

Consistent quality starts by identifying feasibility restrictions, such as:

- Chemical reactivity between components
- Relative volatility of each component in liquid mixtures
- Safety considerations (flammability, toxicity) for individual components and final mixture
- Filling pressure versus dewpoint (as a standard 0°C us applied for gas mixtures with condensable components)

The following table is not restrictive but gives an idea of some of the components that have been qualified over many years in the production of binary mixtures and multicomponent compositions (up to 50 components) in a variety of concentrations and accuracy classes.



(1) Dedicated quality control systems measure the specified maximum impurity levels.

More than 500 qualified components

Chemical classification	Example of qualified components
Acetylenes	Vinyl acetylene - Acetylene - Ethyl acetylene - Dimethyl acetylene
Alcohols	Ethanol - Methanol - Cyclohexanol - n-Butanol
Aldehydes	Acetaldehyde - Acroleine - Benzaldehyde - Butanal
Alkanes	Methane - Ethane - Propane - Cyclopropane - Isopentane - n-Nonane
Alkenes	Ethylene - Propylene - Isobutylene - cis & trans-2-Butene - Allene - 1,3 Butadiene
Aromates	Benzene - Toluene - Ethylbenzene - o,m,p-Xylene - Styrene - Cumene
Cetones	Acetone - Cyclohexanon - Methylethylketon - Methylisobutylketon
Esters	Ethylacetate - Ethylacrylate - Vinylacetate - Butylacrylate
Ethers	Dimethylether - Vinyl Methyl Ether - Tetrahydrofurane - Diethylether
Hydrides	Hydrogenselenide - Diborane - Silane - Germane - Disilane - Phosphine
Inerts	Argon - Helium - Neon - Krypton - Xenon
Low reactive liquid halogenides	Chloroform - Dibromomethane - Trichloroethylene
Low reactive volatile halogenides	Ethylchloride - Methylchloride - Vinylchloride
Nitriles	Acetonitrile - Acrylonitrile
Non-reactive halogenides	Sulphurhexafluoride - Tetrafluoromethane (Halocarbon 14) - Octafluorocyclobutane (RC 318) - Perfluoropropane
Organic sulphur components	Dimethylsulfide - Carbondisulfide - Thiophene - Mercaptans
Reactive anorganic halogenides	Chlorine - Hydrogen chloride - Hydrogen fluoride - Hydrogen bromide - Bromine - Borontrichloride
Reactive organic halogenides	Trifluoroethylene - Vinylfluoride - Allylchloride
Specific components	Water - Sulphur dioxide - Nitric oxides - Hydrogen sulfide - Carbon monoxide - Phosgene

Components are classified by their chemical characteristics. Consult your nearest Sales office for your requests.

Impurity analysis of the components of a mixture is very important. Their contribution in the total mixture may interfere in analysis or they may contribute to unwanted higher concentrations of other components that are requested in low ppm or ppb concentration level.

Calibration mixtures

A correct choice of cylinder material and valve as well as its proper treatment are important for the **stability** of the gas mixture.

The proper cylinder material and valve type is selected depending on the chemical characteristics of the components and their concentration.

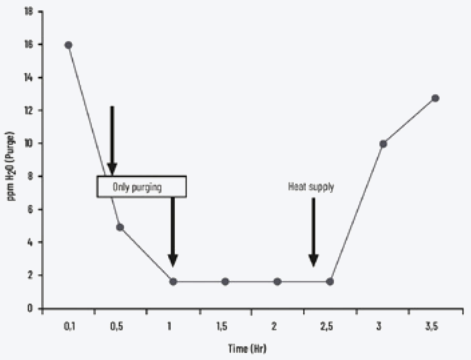
The cylinder is treated and prepared to make the internal wall material inert and non-reactive to the mixture components and may include passivation techniques, internal proprietary owned coating processes and final drying of the cylinder.

All the care taken in the preparation and certification of calibration mixtures, results in an analytical report and a stability guarantee. It's very important that the **right handling material** such as pressure regulators, valves, sampling lines, etc, are properly chosen.

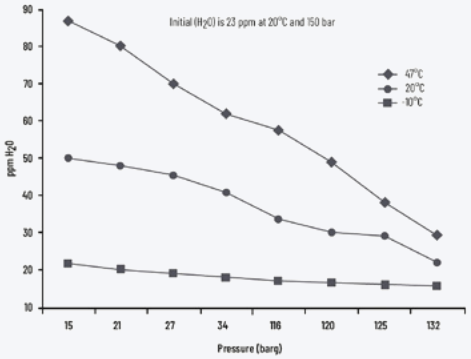
Unsufficient leak tightness may lead to effects of retrodiffusion of ambient air resulting in contamination by, amongst others, O_2 and H_2O.

The following graphs show the effect of an inappropriate treatment. Take a look at the Technical Data chapter for more information on permeability of some commonly used materials.

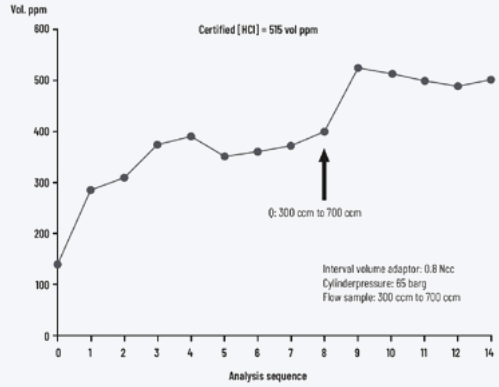
Moisture desorption during heating of a metallic surface



Effect of temperature and pressure on desorption of moisture from a non treated metallic surface



Effect of an untreated adaptor on a HCl analysis



Available categories

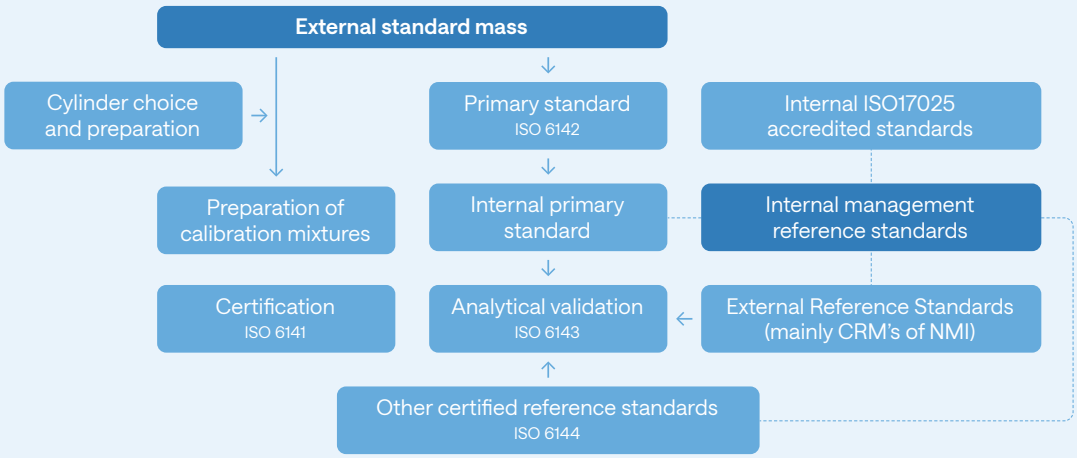
Certified gas standard

This standard is prepared by using gravimetric and volumetric techniques and is certified analytically. The preparation, analytical calibration, laboratory analysis and Certificate of Analysis (CoA) are based on international standards such as ISO6141, 6142, 6143 and 6144, which are updated by the International Standardisation Organisation commission ISO-TC156.

The traceability of the analytical result is related to these norms. The management of internal reference standards and methods are covered by quality system ISO9001.



Traceability of a certified standard



Certified standard specifications in relative %

Component concentration ranges		0,1 - 0,99 ppm	1 - 9,9 ppm	10 - 99 ppm	0,01 - 0,99 %	1 - 9,9 %	> 10 %
Category A	Preparation tolerance	+/- 20%	+/- 20%	+/- 10%	+/- 10%	+/- 5%	+/- 5%
	Certification accuracy	+/- 5%	+/- 5%	+/- 2%	+/- 2%	+/- 2%	+/- 2%
Category B	Preparation tolerance	+/- 40%	+/- 40%	+/- 20%	+/- 10%	+/- 10%	+/- 10%
	Certification accuracy	+/- 10%	+/- 5%	+/- 5%	+/- 2%	+/- 2%	+/- 2%

Preparation tolerance: The maximum relative deviation between the analysed- and the requested concentration
Certification accuracy: The total uncertainty of the analysed concentration within a 95% confidence level
Category A: Concentrations of O_2, CO_2, N_2, SO_2, NH_3, HCl, NO_2 > 100 ppm.
Calibration mixtures in all concentrations with NO, CO, H_2, alkanes, alkenes, dienes, alkyns up to C_4.
Category B: All components and / or concentrations not mentioned in Category A.
The preparation tolerance for multicomponent mixtures with more than 10 components falls under category B.

Calibration mixtures

Certified Liquid Standard

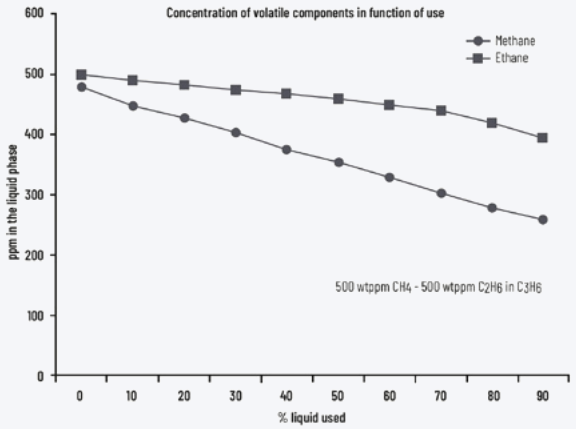
These standards are certified by composition (gravimetrical weights), analysis or acombination of both, depending on the nature and concentration of the component as well as the total matrix of the mixture. The Certificate clearly states which method has been used.

A major application of Liquid Standards is the calibration of chromatographic analysers, monitoring the production of propylence, aromatics and in fuel cracker distillates. These standards could also be used in substitution of gas mixtures with a very low maximum filling pressure (0°C Dewpoint restriction).

They are available in different cylinder sizes equipped with a two-way liquid valve that allows allows drawing the liquid mixture at one side and putting a constant pressure of an inert, preferably Helium because of its low solubilty in hydrocarbon liquid phase, at the other side of the valve.

A liquid mixture cannot contain volatile components, such as methane and ethane, as they will only partially dissolve in the liquid phase. This is also showed in the graph.

Liquid Standard





High Accuracy Gravimetric Standard (Primary Standard)

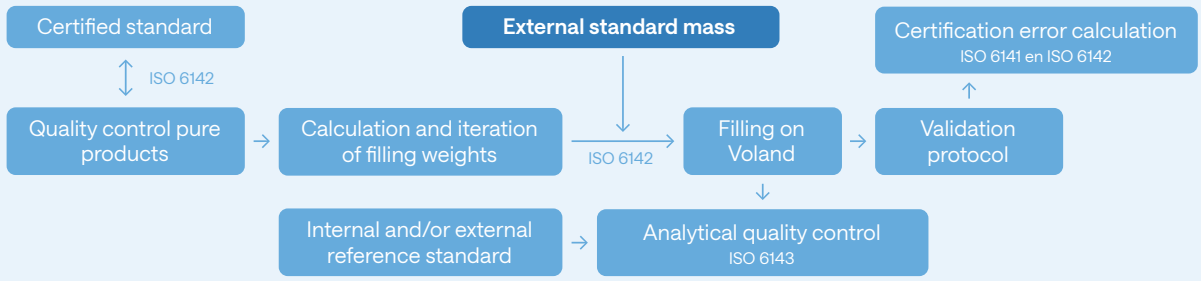
Calibration mixtures are produced gravimetrically on a highly sensitive, accurate analytical weighing device and under strict rules and procedures as described in the ISO norm 6142:

- Components with the highest purity are individually analysed for their impurities.
- Evaluation of the non-reactivity between the individual components.
- Qualification and quantification of all potential error sources, like:
  - Buoyancy effects, humidity, temperature and barometric influence.
  - Effects on the weighing process of cylinder expansion and heating.
  - Uncertainties of the molar mass and impurity analysis.
- Calibrated mass pieces of OIML Class 2 accuracy level.
- Quantification of process uncertainties (linearity, reproductibility, sensitivity, ...).
- Total uncertainty calculation according EAL-R2
- Analytical validation of the gravimetrical result against reference standards.

Nippon Sanso organises and participates in inter-laboratory analysis (round robin) between affiliated companies worldwide and independent laboratories to ensure the validity of its procedures.

Primary standards are applied in calorific value determination, multipoint calibration, quality control of feedstocks and exhaust emission control.

Traceability: Primary Standard



Primary Standard specifications in relative %

Component concentration ranges	10 ppm - 0.99 %	1% - 9.9 %	> 10 %
Preparation tolerance	+/- 5%	+/- 2%	+/- 1%
Certification accuracy	+/- 1%	+/- 0.5%*	+/- 0.2%*

Preparation tolerance: The maximum relative deviation between the certified result and the requested concentration.
Certification accuracy: The total uncertainty of the reported concentration within a 95% confidence level.
***** or 0.02 % absolute whichever is smaller.

Calibration mixtures

Batch Mixtures

They are used for process mixtures in larger quantities and are standardised in composition. Above analytical accuracy, a controlled level of impurities is preferred. They are typically used in cutting, welding and marking lasers. Other applications are found as carrier gas mixture in gas chromatography and Flame Ionisation Detector analysers or as functional gas mixture in nuclear counter analysers. That's why these mixtures are either supplied without certificate of analysis or, for larger quantities, with a batch analysis. The mixtures are prepared in the same way as the certified gas.

"EXPRESS" Calibration mixtures

Consist of Certified Standard Mixtures for calibration purposes, which are deliverable from the shelf. The components and their concentration, the cylinder size and the cylinder connections are predefined. However they are delivered at the same quality level as the Custom-made mixtures, they have a much shorter delivery time. Contact your nearest sales office for the most recent version of the catalog "EXPRESS" Calibration Mixtures.

Example of Batch Mixtures

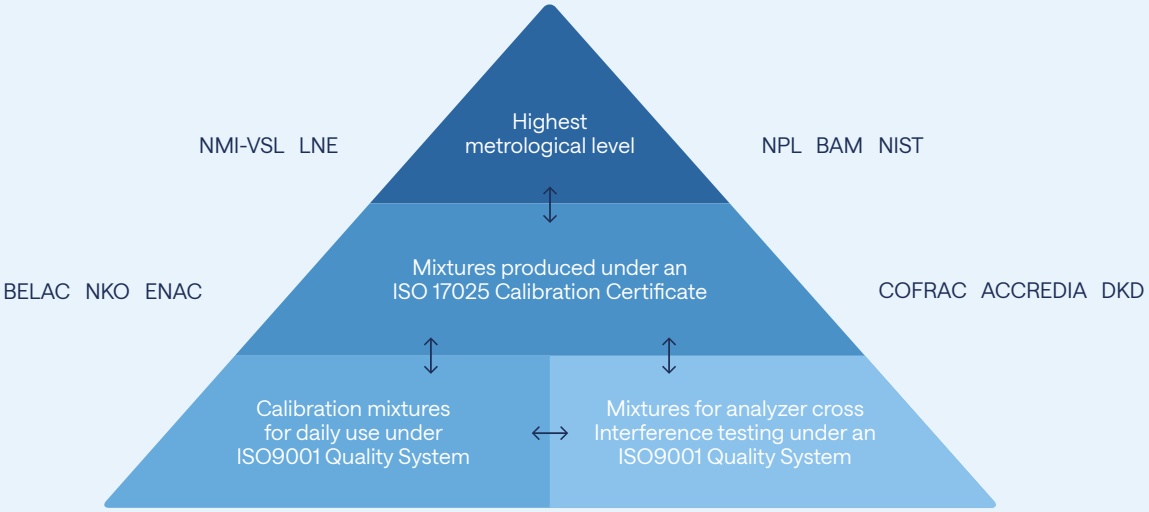
Mixture description	Composition						
	CO	CO_2	N_2	H_2	He	CH_4	Ar
Fuel gas - helid-s	-	-	-	40%	60%	-	-
Helistar 30	-	-	-	-	30%	-	70%
Helistar 40 C1	-	1%	-	-	40%	-	59%
Helistar 50	-	-	-	-	50%	-	50%
Helistar 70	-	-	-	-	70%	-	30%
Lasermix 1	2%	8%	8%	-	82%	-	-
Lasermix 2	2%	8%	16%	-	74%	-	-
Lasermix 3	-	6%	20%	-	74%	-	-
Lasermix 4	4%	8%	16%	-	72%	-	-
Lasermix 5	4%	6%	12%	0.4%	77.6%	-	-
Lasermix 6	4%	9%	18%	0.3%	68.7%	-	-
Lasermix 7	3%	7,5%	15%	0.25%	74.25%	-	-
Lasermix 8	-	5%	55%	-	40%	-	-
Lasermix 9	-	12%	12%	-	76%	-	-
Lasermix 10	-	3.4%	15.6%	-	81%	-	-
Lasermix 11	-	4.5%	13.5%	-	82%	-	-
Lasermix 12	-	1.7%	23.4%	-	74.9%	-	-
Lasermix 13	-	15%	5%	4%	76%	-	-
P5	-	-	-	-	-	5%	95%
P10	-	-	-	-	-	10%	90%

ISO 17025 accredited standard (Calibration Level)

This category of calibration mixtures consists of well defined components and concentration ranges, which are audited by a team of a recognised ISO17025 auditing body and a technical expert.

In comparison with the other mixture categories, for which the certification is covered by a quality system under ISO 9001, these ISO 17025 accredited standards are part of a detailed specific audit program, traceable in their reported results to Chemical Reference Standards of Metrological level, so called CRM's (Certified Reference Material) and PRM's (Primary Reference Material) and/or Mass Pieces certified by accredited (Metrology) institutes.





The scopes indicated in the following tables include, amongst many other applications, areas of calibration for:

- Emission and Air Quality control analysis.
- Calorific Value determination of Natural Gas compositions.
- Quality Control analysis of Hydrocarbon Processing streams, like cracker units.
- Flammability control detection systems.
- Biomethane and biofuel applications.

Calibration mixtures

Two component emission standards - BELAC

Component	Molar concentration range (ppm – %)	Class A uncertainty (k=2 in rel %)	Class B uncertainty (k=2 in rel %)
CO in N_2 or Air	5 ppm – 20%	1% – 0.2%	3% – 0.6%
CO_2 in N_2 or Air	100 ppm – 50%	0,5% – 0.2%	1% – 0.5%
C_3H_8 in N_2 or Air	1 ppm – 10%	1% – 0.2%	2% – 0.6%
NO in N_2	1 ppm – 100 ppm	Not applicable	3% – 1%
NO in N_2	100 ppm – 1%	0.5% – 0.4%	1% – 0.8%
O_2 in N_2	1000 ppm – 25%	0.5% – 0.2%	1% – 0.6%
SO_2 in N_2 or Air	10 ppm – 1%	Not applicable	2%

Preparation tolerance for Class A (see “Primary Standard”)
Preparation tolerance for Class B (see “Certified Standard”)

Multi component emission standards - BELAC

Component	Molar concentration range (ppm – %)	Class B uncertainty (k=2 in rel %)
CO	10 ppm – 1%	2% – 1%
CO_2	5000 ppm – 25%	0.7% – 0.5%
C_3H_8	1 ppm – 1%	2% – 0.6%
SO_2	10 ppm – 1%	2%
NO	10 ppm – 1%	3% – 2%
O_2	5000 ppm – 25%	1% – 0.6%
N_2 or Air	Balance gas	Balance gas

O_2 is not possible as component in combination with NO
Uncertainties and component combinations available on request
Preparation tolerance Class A (see “Primary Standard”)
Preparation tolerance Class B (see “Certified Standard”)

Natural gas multi component standard - BELAC

Component	Molar concentration Class A range (ppm - %)	Class A uncertainty (k=2 in rel %)	Molar concentration Class B range (ppm - %)	Class B uncertainty (k=2 in rel %
CH_4	50% - 99.8%	0.02% abs	50% - 99.8%	0.5%
C_2H_6	2500 ppm - 15%	0,5% - 0.15%	100 ppm - 15%	2% - 0.8%
C_3H_8	1000 ppm - 10%	0,5% - 0.2%	50 ppm - 10%	3% - 0.8%
ISO-C_4H_{10}	100 ppm - 2.5%	1% - 0.3%	50 ppm - 2.5%	3% - 1%
N-C_4H_{10}	100 ppm - 2.5%	1% - 0.3%	50 ppm - 2.5%	3% - 1%
NEO-C_5H_{12}	50 ppm - 5000 ppm	3% - 1%	50 ppm - 5000 ppm	5% - 2%
ISO-C_5H_{12}	50 ppm - 5000 ppm	2% - 0.5%	50 ppm - 5000 ppm	3% - 1.5%
N-C_5H_{12}	50 ppm - 5000 ppm	2% - 0.5%	50 ppm - 5000 ppm	3% - 1.5%
N-C_6H_{14}	50 ppm - 5000 ppm	2% - 0.5%	50 ppm - 5000 ppm	3% - 1.5%
N_2	500 ppm - 20%	2% - 0.2%	50 ppm - 20%	5% - 0.8%
CO_2	500 ppm - 20%	1% - 0.1%	50 ppm - 20%	3% - 0.8%
Helium	-	-	50 ppm - 2%	5% - 2%
O_2	-	-	100 ppm - 3%	5% - 2%

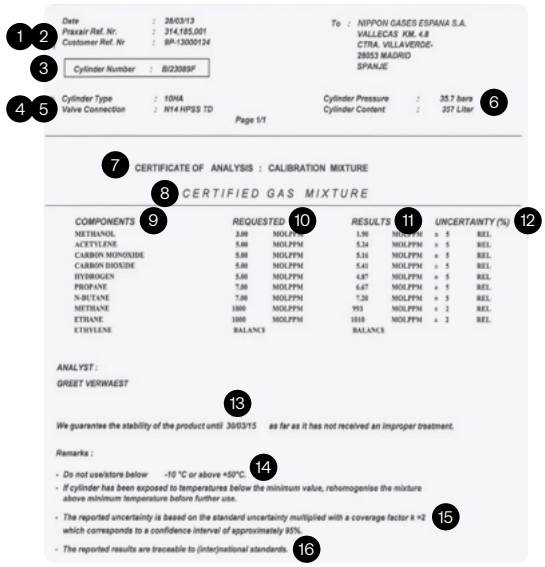
Preparation tolerance for Class A (see “Primary Standard”)
Preparation tolerance for Class B (see “Certified Standard”)

Multi component HydroCarbon Standards - BELAC

Component	Molar concentration range (ppm - %)	Class A uncertainty (k=2 in rel %)
Acetylene	5 ppm - 10%	2% - 0.5%
Carbon monoxide	5 ppm - 70%	1% - 0.2%
Ethane	5 ppm - 100%	1% - 0.2%
Ethylene	5 ppm - 100%	1% - 0.2%
Methane	5 ppm - 100%	1% - 0.1%
Propane	5 ppm - 100%	1% - 0.2%
Propylene	5 ppm - 100%	1% - 0.3%
Benzene	50 ppm - 0,5%	2% - 0.5%
Cyclohexane	50 ppm - 0,5%	2% - 0.7%
n-Hexane	50 ppm - 0,5%	2% - 0.5%
1-Hexene	50 ppm - 0,5%	2% - 0.7%
Isopentane	50 ppm - 0,5%	2% - 0.5%
n-Pentane	50 ppm - 0,5%	2% - 0.5%
Allene	50 ppm - 10%	3% - 1.5%
1,3-Butadiene	50 ppm - 10%	3% - 1%
n-Butane	50 ppm - 10%	1% - 0.4%

Component	Molar concentration range (ppm - %)	Class A uncertainty (k=2 in rel %)
1-Butene	50 ppm - 10%	1% - 0.4%
cis-2-Butene	50 ppm - 10%	3% - 1%
2,2 Dimethylpropane	50 ppm - 5%	3% - 1%
Ethylacetylene	50 ppm - 10%	3% - 1%
Isobutane	50 ppm - 10%	1% - 0.4%
Isobutylene	50 ppm - 10%	1% - 0.4%
Methylacetylene	50 ppm - 10%	3% - 1%
trans-2-Butene	50 ppm - 10%	3% - 1%
Carbon dioxide	100 ppm - 100%	2% - 0.2%
Nitrous oxide	100 ppm - 100%	1% - 0.2%
Cyclopropane	500 ppm - 10%	2% - 1%
Oxygen	0.1% - 25%	1% - 0.2%
Argon	0.1% - 100%	1,5% - 0.2%
Helium	0.1% - 100%	1% - 0.1%
Hydrogen	0.1% - 100%	1% - 0.1%
Nitrogen	0.1% - 100%	1% - 0.1%

Prepared according ISO6142:2001. / Composition verified by gas analysis according ISO6143:2001.
Available in 10, 20, 40 (Germany only) and 50 Liter aluminum cylinders. / Component combinations and concentrations subject of individual approval.



The certificate of analyses (CoA) : A source of useful information

(1) Internal Nippon Sanso work order reference, which allows us to trace back production and laboratory certification data of the mixture.
(2) Customer reference order.
(3) Individual cylinder number and barcode reference, which allows us to trace back all relevant data to the mixture and its cylinder, such as the workorder. reference, former service of the cylinder (content and customer), re-approval date of the cylinder..
(4) Type of cylinder. The number indicates the water capacity and the characters the cylinder material or treatment..
(HA = Aluminium, H&HH = Steel, HQ = Internally coated cylinder, L = Low pressure (max 20 bar). Details? See page 33.
(5) Indicates the valve connection and material (Stainless Steel or Brass).
(6) Absolute filling pressure and corresponding content in liter (before analytial laboratory certification or validation of the mixture).
(7) Type of Certificate (Analysis, composition or batch).
(8) Category of calibration mixture. Details? See page 15.
(9) Listing of the required components.
(10) Requested concentration of each component.
(11) Certification result.
(12) Certification uncertainty expressed in relative % or in absolute value of the reported concentration
(13) Stability guarantee of the calibration mixture.
(14) Minimum- (in function of the mixture's dewpoint) and maximum (in function of cylinder material) usage temperature.
(15) The statistical confidence level of the reported uncertainty.
(16) Traceability statement refering to the corresponding flowcharts on pages 13 and 15 of this brochure.

Helium
A unique resource for unique applications

Why choose Nippon Sanso?

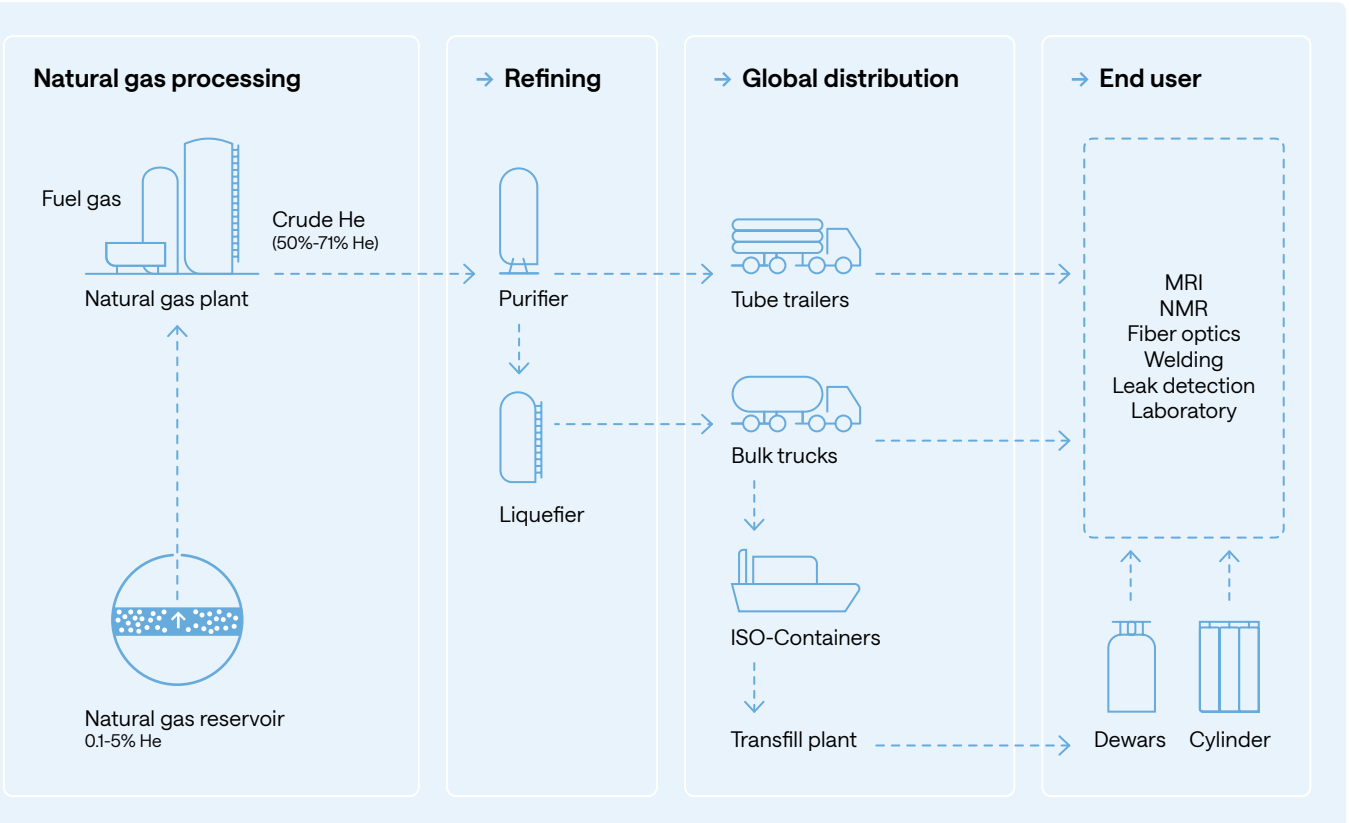
Nippon Sanso is one of the industry leaders in Helium. Present all over the world, the company is technology driven and has a comprehensive logistics system.

Some other advantages:
- Reliability of supplies as a main priority
- Diversity of secured sources
- Constant investment in helium infrastructure
- Global Supply Chain Management

A grasp of the many applications

- Carrier gas for gas chromatography
- Shielding medium for welding of high quality metals and alloys
- Deep sea diving (Trimix)
- Production of optical fibers
- Cooling of magnets in research (NMR) and medical imaging (MRI)
- Weather balloons, transport airships, lifting applications





Electronic gases and mixtures
Serving the semiconductor and photovoltaic industry

Nippon Sanso Electronics offers advanced products and services to the global semiconductor and photovoltaic manufacturing industries. As such, the company aims to meet customers' two strategic goals: improving the productivity and advancing technology.

High purity process gases

Nippon Sanso offers silicon, precursors, dopants, etchants, reactants, mixtures and inerts. All of these are available in every major cylinder and valve type. Nippon Sanso Electronics has gas manufacturing and processing facilities worldwide.

Nippon Sanso's plant in Oevel (Belgium) offers a complete portfolio of gases with state-of-the-art automated equipment and advanced technology processes to drain, prepare, fill and test cylinders to meet the higher standards required for next-generation devices. Similar dedicated facilities and research centers are located in Japan and the USA.









(1) Processing manifolds for Germane and Diborane filling. / (2) Quality Control Data Registration. / (3,4) High purity dichlorosilane filling under cleanroom conditions.

Electronic gases and mixtures

Bulk process gases

To help improve productivity, enhance safety and lower costs, Nippon Sanso Electronics also provides bulk semiconductor process gases.

Due to the Nippon Sanso's experience in customised equipment and installation designs, the company provides cost-effective solutions for key process gases, such as silane, ammonia, halocarbons, nitrogen, trifluoride and other common high-volume products.

Other products and services

- Electronics material gases
- Piping
- Remote monitoring systems
- Analysers
- Cylinder cabinets
- Exhaust gas abatement equipment
- MOCVD equipment
- Purifiers
- Life safety alarm systems
- Bulk gases
  Ultra-high-purity N_2, O_2, Ar, H_2, He
- Other services

Key process gases for semiconductor and photovoltaic industries

Product	Grade
Ammonia	5.0 - 6.0 - 6.5
Boron trichloride	4.0 - 5.0
Boron trifluoride	2.5
Boron11 trifluoride	2.7
Chlorine	4.0 - 4.8
Dichlorosilane	2.0 - 2.7
Disilane	4.8
Germane	5.0
Halocarbon-14	4.7
Halocarbon-23	4.5
Halocarbon-116	3.6
Halocarbon-116	5.0

Product	Grade
Halocarbon-c318	4.0
Hexafluoro-1,3-butadiene	3.5
Hydrogen bromide	4.5
Hydrogen chloride	4.5 - 4.8 - 5.0
Nitrogen trifluoride	4.0
Nitrous oxide	4.8 - 5.5
Octafluorotetrahydrofuran	2.5
Phosphine	5.5 - 5.8
Silane	4.0 - 5.0 - 6.0
Silicon tetrafluoride	4.0
Sulphur hexafluoride	4.5
Tungsten hexafluoride	3.0 - 5.0

Process gases
The right product for chemical synthesis and research

Nippon Sanso offers a wide variety of inorganic and organic chemicals, which are available in different purities and package sizes, adapted to customers' specific applications.

Inorganic process gases

Inorganic process gases are used for chemical synthesis on laboratory, pilot and industrial scale. Among the many applications, they include for example the production of active components in pharmaceutical industry, acid-base neutralisation processes and halogenation reactions.

Organic process gases

Organic process gases are mainly hydrocarbon products used for chemical synthesis, catalyst research and pilot reactor processes. They are available in different purities.



Process gases for pharmaceutical synthesis, catalyst, laboratory and pilot reserach

Inorganic product	Grade
Ammonia	3.8
Chlorine	2.8
Hydrogen bromide	2.8
Hydrogen chloride	2.5
Hydrogen fluoride	3.5
Hydrogen sulphide	2.8
Phosgene	1.85
Sulphur dioxide	3.8
Sulphur hexafluoride	3.0
Vinylchloride	3.5

Organic product	Grade
1-Butene	2.6
Dimethylether	3.0
Ethane	2.5 - 3.5 - 4.5 - 5.0
Ethylchloride	2.8
Ethylene	3.0 - 3.5 - 4.5 - 5.0
Isobutane	2.5 - 3.5
Isobutylene	3.0
N-butane	2.5 - 3.5
Propane	2.5 - 3.5 - 4.0 - 5.0
Propylene	2.5 - 3.5 - 4.0

(1) A wide range of products and purities

Food packaging
Keeping food fresh

Frozen, chilled, crisp, fresh, fizzy. With Nippon Sanso's gases and applications, everything is possible. Nippon Sanso offers a total system approach, ensuring customers receive products and gases that are optimised for their operations.

We help you deliver high quality food and beverage straight to your customers so you can meet their ever-changing needs.

Services

Nippon Sanso does more than just delivering the right product for food applications: assisting with analytical services, a dedicated program of appropriate gas handling equipment and supporting gas supply installations.



Bulk & Cylinder deliveries

Carbon dioxide
A key cryogenic agent in cooling, chilling and freezing applications, which protects the taste and texture of food products by maintaining proper temperature control. The gas also reduces the need for preservatives in packaged products and is an essential ingredient for fizz in carbonated beverages.

Nitrogen
Also a key cryogenic agent in cooling, chilling and food freezing. Thanks to its extremely cold temperatures, immersion freezing in liquid nitrogen is the fastest freezing method known for producing individually quick frozen (IQF) foods. Nitrogen also plays a key role in reducing spoilage, discoloration and off-flavors, while giving strength to retail packaging.

Oxygen
Used in aquaculture to deliver the dissolved oxygen levels which are needed for high production levels and fish health. The gas is also key to provide an increase of dissolved oxygen levels for enhanced aeration and aerobic digestion in food wastewater streams.

Modified Atmosphere Packaging (MAP) gases
Used by food processors and packagers to extend the shelf life of their products. The gases include a mixture of pure nitrogen, carbon dioxide and oxygen.

This mixture displaces unwanted atmospheric gases and extend the shelf life of food products. A wide range of specialty gas mixtures compositions can help food processors and packers to select the right option to fit their specific needs.

Equipment for Specialty Gases
Role of equipment in gas applications

All the care that has been taken to guarantee the stability of a calibration mixture or a specified maximum impurity level in high purity gases should not be jeapordized by improper equipment.

In addition, the equipment has to respond to all functional, safety and quality aspects of the corresponding gas application. Nippon Sanso has decades of experience in the design, equipment, selection, assembly and installation of gas handling systems as used in laboratories, universities and research, semiconductor, chemical, pharmaceutical and many other demanding industries.

Functional aspects

For safety reasons and local regulations, gas cylinders are mostly installed at a central location.

The gas or gas mixture should be transferred from its cylinder to the point of use, at the specified pressure and flowrate but also with the original specifications contained and specified in the cylinders.

Safety aspects

Starting from the high pressure in the gas cylinder, the equipment has to provide a constant reduced pressure at the point of use, while assuring leaktightness to avoid contamination of the work environment by the often hazardeous characteristics of the gases in use like flammability, toxicity and corrosivity.

Quality aspects

Intrusion of ambient impurities like for example O_2 and H_2O (retrodiffusion) in a gas handling system will lead to detoriation of the stability of certain calibration mixtures and contamination of high purity gases. Leaktightness of the equipment and the overall installation (piping, connection, points, welded points, etc.) should be guaranteed and certified.

Nippon Sanso specifies a leakage rate of less than 10-9 mbar l/s Helium for all its standard equipment components.



Equipment for Specialty Gases

Standard equipment program

The standard equipment program is a comprehensive program covering all basis requirements for a safe and qualitative handling of specialty gas applications, which is available in electropolished stainless steel 316L or chrome plated brass:

Pressure regulators
Pressure regulators are available in single stage and double stage design. The double stage regulator is used in applications where constant outlet pressure is required. Take a look at page 31 for a more detailed explanation.

Point-of-use regulators
Point-of-use regulators are compact single stage regulators for use close to applications. They can be mounted on a wall panel or on a wall mounted shut-off valve which allows nterchanging regulators from one user location to the other. Nippon Sanso offers different orientations and connection options for inlet and outlet.

Gas Distribution Panels
Nippon Sanso offers 3 standard solutions that cover most of the gas applications:

- Panel to connect one cylinder of an inert and non flammable gas of medium quality. It has no purging facility.
- Panel to connect one cylinder of an inert or flammable gas of medium or high quality. It has a purging facility by using the connected gas
- Panel to connect one cylinder of toxic, corrosive or flammable gas of medium to high quality. It has a cross purging facility by using an inert assist gas, like Nitrogen 6.0

Valves
- Diaphragm shut-off valve
- Diaphragm regulating valve

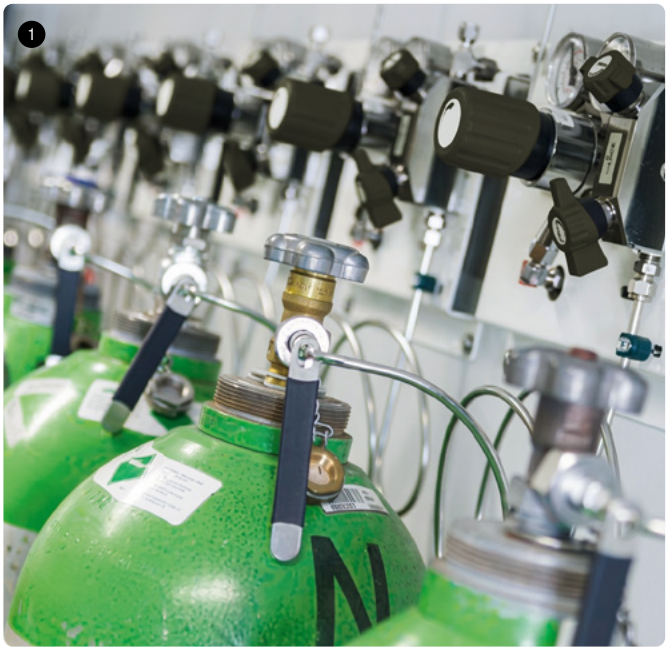
Switch-over systems
A switch-over system is a gas supply panel for connecting two cylinders with an automatic switch-over to guarantee continuous gas supply. It is extendable to connect more cylinders at each side and used for gases of medium to high purity and equipped with purge facility.

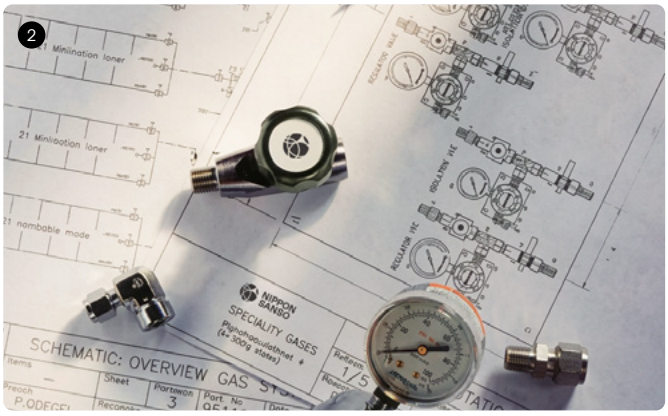
Customised solutions

Nippon Sanso' field service technicians are available assistance from concept to execution based on application, requirements, budget and safety related aspects.

Services

Nippon Sanso's service technicians are VCA2 certified (Veiligheid Certificaat Aannemers - Safety Certificate Contractors). Thanks to this certificate, they are also qualified to act in a supervision role with external subcontractors.





(1) From concept to realization
(2) Central Gas Distribution system with purging facility

Technical data

ADR Transport labeling



N° 2.2

Non-flammable, non-toxic gases



N° 2.3

Toxic gases



N° 8

Corrosive substances, supplements label 2.3 for the toxic and corrosive gases



N° 2.1

Flammable gases



N° 5.1

Oxidising substances, supplements label 2.2 or label 2.3 for the oxidising gases



Environment

Environmentally hazardous substance mark for gases classified for acute and/or chronic aquatic toxicity

GHS (Global Harmonisation System) product labeling

Under the GHS is implemented:

CLP (Classification & Labelling, EC regulation No 1272/2008 (published 31/12/2008)

SDS (Safety Data Sheets) EC REACH Regulation No 1907/2006 (published 30 Dec. 2006 with amendments) REACH (Registration Evaluation Authorisation and restriction of Chemicals) requires a 3 step registration by manufacturers and importers for the classification and safe use of substances:

- > 1.000 ton/year 1.12.2010
- 100 ton/year - 1.000 ton/year 1.06.2013
- > 1 ton/year - 100 ton/year 1.06.2018



NEW_Flammable

(reference to ISO 10156)



NEW_Corrosive

(reference to ISO 13338)



NEW_Oxidising

(reference to ISO 10156)



NEW_CMR

(Carcinogenic/mutagenic/ reproductive toxic), respiratory sensitization, specific target organ toxicity



NEW_ Gases under pressure



NEW_Acute Toxicity

Category 4, skin irritation, eye irritation, skin sensitization, respiratory tract irritation



NEW_ Toxic/Very Toxic

(LC 50 values in P200 of UN-RTDG or in ISO 10298)



NEW_ Toxic to the aquatic environment

Color code identification

According to norm EN 1089-3 applicable for industrial and medical gas cylinders, not for refrigerants, LPG, propane and butane liquified gases. Not applicable for cylinder bundles (packed frames of several individual cylinders). Color code applies to the upper part of the cylinder (“neck”).

General guidelines		
Toxic and/or corrosive	Yellow	RAL 1018
Flammable	Red	RAL 3000
Oxydising	Light blue	RAL 5012
Inert (asphyxiant)	Bright green	RAL 6018
Medical	White	Cylinder body

Technical data

Laboratory applications - Gas purity guidelines for some common applications

Analytical method	Support gas	Measuring sensitivity & purity recomendations			Application and impurity considerations
		ppb	< 100 ppm	> 100 ppm	
Gas chromatography					
TCD Thermal conductivity detector	N_2 He	N/A N/A	5.6 5.6	5.0 5.0	**Universal detector** / O_2 and H_2O can oxidise the detector filament giving rise to negative peaks and reduced sensitivity
FID Flame ionization detector					
Carrier gases	He N_2	6.0 6.0	5.6 5.6	5.0 5.0	**Organic compounds** /Total Hydrocarbons (THC) in carrier and fuel gases can give rise to baseline noise and reduced detector sensitivity. Oxygen and H_2O cause column deterioration and affect retention time on critical applications.
Combustion gases	H_2 40% H_2 / He 40% H_2 / N_2 Air	N/A Batch Batch N/A	6.0 Batch Batch 5.0	5.0 Batch Batch 4.5	
ECD Electron capture detector	He N_2 5% CH_4 / Ar 10% CH_4 / Ar	6.0 6.0 Batch Batch	5.6 5.6 Batch Batch	5.6 5.6 Batch Batch	**Halogenated compounds** / Detector response and column life are reduced by Oxygen and H_2O. Hydrocarbons and Halocarbons can produce baseline noise, negative peaks and plumbing contamination.
HID Helium ionization detector	He	6.0	5.6	5.6	**Universal detector** / Atmospheric impurities can cause baseline noise, signal polarity and reduced detector stability and sensitivity.
FPD Flame photometric detector					
Carrier gases	He N_2	6.0 6.0	5.6 5.6	5.0 5.0	**Sulfur or phosphorous compounds** / Hydrocarbon impurities can yield baseline noise and carbon dioxide can suppress detector response.
Combustion gases	H_2 Air	6.0 5.7	5.0 5.0	5.0 5.0	
PID Photo ionization detector	He N_2	5.6 5.6	5.6 5.6	5.0 5.0	**Selective Detector – Dependent on UV source** / Hydrocarbons cause baseline noise and Oxygen can suppress detector response.
GC-MS Mass spectrometer	He N_2 Ar	6.0 6.0 6.0	6.0 6.0 6.0	5.0 5.0 5.0	**All compounds** / Analytical inaccuracies can result from any impurity coinciding with quantified peak responses.
USD Ultrasonic detector	Ar He	6.0 6.0	5.0 5.0	4.8 / 5.0 4.6 / 5.0	**Universal detector** / See HID

Analytical method	Support gas	Measuring sensitivity & purity recomendations			Application and impurity considerations
		ppb	< 100 ppm	> 100 ppm	
Optical spectrometry - Absorption methods					
NDIR Non dispersive infrared	Ar N_2	5.0 5.0	4.5 4.8	4.5 4.8	**Polyatomic and heteroatomic compounds**
IR - FTIR Infrared	Air N_2	5.0 5.0	5.0 5.0	5.0 5.0	**Polyatomic and heteroatomic compounds** / Oxydation risk of the sample. H_2O interferes with IR spectra.
AA Atomic absorption	C_2H_2 H_2 N_2O Air Ar N_2	N/A	2.6 4.5 2.5 4.5 5.0 5.0	2.6 4.5 2.5 4.5 5.0 5.0	**Elemental analysis** / Impurities can cause the flame to discolour or burn unevenly. Furnace atmospheres require low Oxygen and H_2O level to maintain sensitivity.
NMR Nuclear magnetic resonance	Liquid He Liquid N_2	5.0 5.0	5.0 5.0	5.0 5.0	**Analysis of molecular structure**
Optical spectrometry - Emission methods					
ICP Inductive coupled plasma	Ar Liquid Ar N_2	4.8 5.0 5.0	4.8 5.0 5.0	4.8 5.0 5.0	**Elemental analysis**
Mass spectrometry					
MS Vacuum mass spectrometry	Ar N_2 He	6.0 6.0 6.0	5.0 5.6 5.6	5.0 5.6 5.6	All compounds
Specific component analysers					
Nuclear counter	10% CH_4 / Ar 10% CO_2 / Ar 1.3% C_4H_{10} / He	Batch Certified Certified Certified	Batch Certified Certified Certified	Batch Certified Certified Certified	Measurement of radioactivity
Hygrometer - Dewpointmeter	N_2	6.0	6.0	5.0	H_2O (humidity) in all gases
Paramagnetic analyser	N_2 O_2 / N_2	6.0 Certified	6.0 Certified	5.0 Certified	Oxygen in all gases

Technical data

Physical parameters

Product	Synonym	Chemical formula	Density at 21°C (g/l)	Molar weight (g/mol)	Partial pressure at 0°C (bara)	Partial pressure at 15°C (bara)	Lower flammability limit in air (ISO 10156)*
1,3-Butadiene	Vinylethylene/Bivinyl	C_4H_6	2.32	54.1	1.2	2	2.0%
1-Butene	Alpha-butylene	C_4H_8	2.40	56.1	1.25	2.2	1.6%
Acetylene	Ethyne	C_2H_2	1.09	26.0	27	39	2.5%
Air	-	-	1.20	28.9	-	-	Oxydiser
Ammonia	-	NH_3	0.72	17.0	3.9	6.9	16.0%
Argon	-	Ar	1.66	39.9	-	-	Non-flammable
Boron trichloride	-	BCl_3	4.96	117.2	0.6	1.2	Non-flammable
Boron trifluoride	-	BF_3	2.78	67.8	82.2	-	Non-flammable
Carbon dioxide	-	CO_2	1.83	44.0	34	49	Non-flammable
Carbon monoxide	-	CO	1.16	28.0	-	-	12.5%
Chlorine	-	CL_2	2.98	70.9	3.4	5.6	Oxydiser
cis-2-Butene	Cis-beta-butylene	C_4H_8	2.40	56.1	0.9	1.6	1.7%
Cyclopropane	Trimethylene	$(CH_2)_3$	1.77	42.1	3.45	5.1	2.4%
Deuterium	-	D_2	0.17	4.0	-	-	5.0%
Diborane	-	B_2H_6	1.16	27.7	27	39	0.8%
Dibromomethane	Methylene bromide	CH_2Br_2	2477	173.8	0.015	-	Non-flammable
Dimethylether	Methoxymethane	$(CH_3)_2O$	1.95	46.1	2.6	4.3	3.4%
Disilane	-	Si_2H_6	2.61	62.1	1.75	2.9	Flammable
Ethane	-	C_2H_6	1.26	30.1	24	34	3.0%
Ethyl chloride	Chloroethane	C_2H_5CL	2.69	64.5	0.6	1.2	3.8%
Ethylacetylene	1-Butyne	C_4H_6	2.30	54.1	0.75	1.4	2.0%
Ethylene	Ethene	C_2H_4	1.17	28.1	35.8	45.6	2.7%
Germane	-	GeH_4	3.19	76.6	25	36	Flammable
Helium	-	He	0.17	4.0	-	-	Non-flammable
Hydrogen	-	H_2	0.08	2.0	-	-	4.0%
Hydrogen bromide	-	HBr	3.34	80.9	12.8	19.8	Non-flammable
Hydrogen chloride	-	HCl	1.53	36.5	25	36	Non-flammable
Hydrogen fluoride	-	HF	1.78	20.0	0.48	0.8	Non-flammable
Hydrogen selenide	-	H_2Se	3.37	81.0	5	7.6	Flammable

(*) Values may be different in function of internal safety procedures and considerations.

Product	Synonym	Chemical formula	Density at 21°C /g/l)	Molar weight (g/mol)	Partial pressure at 0°C (bara)	Partial pressure at 15°C (bara)	Lower flammability limit in air (ISO 10156)*
Hydrogen sulfide	-	H_2S	1.43	34.1	10.2	15.5	4.3%
Isobutane	2-Methylpropane	C_4H_{10}	2.47	58.1	1.7	2.8	1.8%
Isobutylene	2-Methylpropene/Isobutene	C_4H_8	2.39	56.1	1.4	2.3	1.8%
Isopentane	2-Methyl butane	C_5H_{12}	620	72.2	0.3	0.6	1.4%
Krypton	-	Kr	3.48	83.8	-	-	Non-flammable
Methane	-	CH_4	0.67	16.0	-	-	4.4%
Methyl acetylene	Allylene/Propyne	C_3H_4	1.68	40.1	2.9	4.6	1.7%
Methylbromide	Bromomethane	CH_3Br	4.04	94.9	0.9	1.6	5.6%
Methylchloride	Chloromethane	CH_3Cl	2.12	50.5	2.7	4.4	8.1%
n-Butane	Butane	C_4H_1O	2.49	58.1	1.0	1.6	1.9%
Neon	-	Ne	0.84	20.2	-	-	Non-flammable
Nitrogen trifluoride	-	NF_3	2.96	71.0	130	-	Non-flammable
Nitric oxide	-	NO	1.24	30.0	-	-	Oxydiser
Nitrogen	-	N_2	1.16	28.0	-	-	Non-flammable
Nitrogen dioxide	-	NO_2 (N_2O_4)	(2.00)	46.0	0.38	0.8	Oxydiser
Nitrous oxide	-	N_2O	1.84	44.0	31.5	46	Oxydiser
Oxygen	-	O_2	1.33	32.0	-	-	Oxydiser
Pentane	-	C_5H_{12}	626	72.2	0.22	0.4	1.1%
Phosgene	Carbonyl chloride	$COCl_2$	4.19	98.9	0.75	1.4	Non-flammable
Phosphine	-	PH_3	1.41	34.0	23	32	Flammable
Propane	-	C_3H_8	1.86	44.1	5.1	7.8	2.1%
Propylene	Propene	C_3H_6	1.78	42.1	6.8	10	2.0%
R-116	Perfluoroethane	C_2F_6	5.73	138.0	18.5	27	Non-flammable
R-14	Tetrafluoromethane	CF_4	3.64	88.0	-	-	Non-flammable
R-23	Trifluoromethane	CHF_3	2.91	70.0	24.5	37	Non-flammable
RC-318	Perfluorocyclobutane	C_4F_8	8.66	200.0	1.05	-	Non-flammable
Silane	-	SiH_4	1.34	32.1	52	73	Flammable
Silicon tetrafluoride	-	SiF_4	4.36	104.1	64	110.0	Non-flammable
Sulphur dioxide	-	SO_2	2.72	64.1	2	2.8	Non-flammable
Sulphur hexafluoride	-	SF_6	6.10	146.1	13	19	Non-flammable
trans-2-Butene	Trans-beta-butylene	C_4H_8	2.40	56.1	1.07	1.7	1.8%
Vinyl chloride	Chloroethylene	C_2H_3Cl	2.61	62.5	1.9	3	3.6%
Vinylacetylene	1-Buten-3-yne	C_4H_4	2.21	52.1	0.9	1.4	1.9%
Xenon	-	Xe	5.47	131.3	41.8	56.6	Non-flammable

(*) Values may be different in function of internal safety procedures and considerations.

Technical data

Compatibility of metals, polymers and elastomer

Product	Metals			Polymers			Elastomers			
	Cu	Inox	Monel	Teflon (PTFE)	Kel-F	Tefzel	Buna-N	Neopren	Viton	Kalrez
Acetylene	U	S	S	S	S	S	U-WN	U-WN	U-WN	S
Air	S	S	S	S	S	S	S	S	S	S
Ammonia	U	S	S	S	S	S	S-W	S	U-W	X
Argon	S	S	S	S	S	S	S	S	S	S
Boron trichloride	S	S	S	S	S	S	U-W	U-W	S	X
1,3-Butadiene	S	S	S	S	S	S	U-D-M	U-D-M	S	S
N-butane	S	S	S	S	S	S	S	S	S	S
Carbon dioxide	S	S	S	S	S	S	U-D-W	U-D-W	U-D-W	S
Carbon monoxide	S	S	S	S	S	S	U-D	S	S	S
Chlorine	U	S	S	S	S	S	U-F	U-F	S	S
Deuterium	S	S	S	S-P	S	S	S	S	S	S
Ethane	S	S	S	S	S	S	S	U-D	S	S
Ethyl chloride	S	S	S	S	S	S	S	S	S	S
Ethylene	S	S	S	S	S	S	S	S	S	S
Helium	S	S	S	S	S	S	S	S	S	S
Hydrogen	S	S	S	S-P	S	S	S	S	S	S
Hydrogen bromide	U	S	S	S	I	I	U-W	U-W	S	I
Hydrogen chloride	U	S	S	S	S	S	U-W	U-W	S	S
Hydrogen fluoride	U	S	S	S	S	I	U-W	U-W	S	I
Hydrogen sulphide	I	S	S	S	S	S	U-W	U-W	U-W	S
Isobutane	S	S	S	S	S	S	S	S	S	S
Isobutylene	S	S	S	S	S	S	S	S	U-D	S
Krypton	S	S	S	S	S	S	I	I	I	I
Methane	S	S	S	S	S	S	S	S	S	S
Methylbromide	U	S	U	S	I	I	U-D	U-D	S	I
Methylchloride	S	S	U	S	S	S	U-D	U-D	S	S
Neon	S	S	S	S	S	S	S	S	S	S
Nitric oxide	U	S	S	S	S	S	U-F-W	U-F-W	S	S

Product	Metals			Polymers			Elastomers			
	Cu	Inox	Monel	Teflon (PTFE)	Kel-F	Tefzel	Buna-N	Neopren	Viton	Kalrez
Nitrogen	S	S	S	S	S	S	S	S	S	S
Nitrous oxide	C3	C11	S	O	O	X	U-F-D	U-F-D	O-S	X
Oxygen	S	C12	S	O-S	O-S	O	O	O	O-S	O-S
Phosgene	U	S	S	S	I	I	U-W	U-W	S	I
Propane	S	S	S	S	S	S	S	U-D	S	I
Propylene	S	S	S	S	S	S	U-D	U-D	S	S
Sulphur dioxide	U	S	S	S	S	S	U-W	U-W	U-W	S
Sulphur hexafluoride	S	S	S	S	S	S	S	S	S	X
Xenon	S	S	S	S	S	S	S	S	S	S

Legend

Symbol	Description of compatibility
C11	Satisfactory below 6.9 MPa
C12	These materials may be ignitable in oxygen enriched environments. Successful usage upon considerations such as oxygen purity, pressure, velocity, temperature, system cleanliness and presence of potential ignition mechanisms. See relevant Praxair Standards.
C3	Generally unsatisfactory, except where specific use conditions have proven acceptable.
D	Compatibility risk due to dimensional change, swelling enlargement.
F	Compatibility risk due to explosion or fire hazard.
I	Insufficient data available to determine compatibility with the inteded gas.
M	Compatibility risk to change in mechanical properties.
N	Compatibility risk due to normal impurities in gas.
O	All non metallics, even those though considered compatible, may be ignitable in oxygen enriched environments or in other oxidising gases. Successful use depends upon oxygen purity, pressure, temperature, cleanliness and elimination of ignition mechanisms. System design is important. See ASTM G63 and relevant Praxair Standards.
P	Compatibility risk due to permeation.
S	Satisfactory for use with the intended gas.
U	Unsatisfactory for use with the intended gas.
W	Compatibility risk due to weight loss.
X	Compatibility varies depending upon specific compound used.

Consult vendor for information on specific applications.

Technical data

Permeability rate in Ncc/hr.m (x 10^{-3})

Material	Helium	Nitrogen	Oxygen	Moisture
Kel-F	50.4	0.1	0.07	0.74
Nylon-6	3,6	0.027	0.08	482
Polyethylene	13.3	5	15	245
Tefon (PTFE)	1883	7.7	27	97
Viton	45.7	1.1	3.9	115
Neoprene G	12.2	3.2	10.8	-

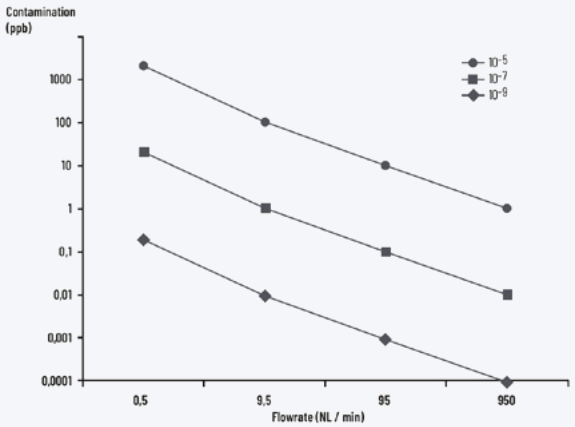
Nitrogen, oxygen and moisture are major ambient air constituents
Helium is preferably used for leak testing purposes (high permeability)

Leak tightness

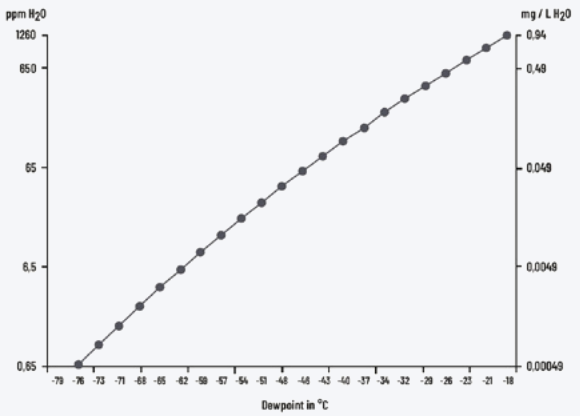
Leakrate (mbar L/sec)	Equivalent (1ml per)	Equivalent (N° of bubbles in water)
10^{-1}	10 sec	Steady stream
10^{-2}	100 sec	1 per sec
10^{-3}	20 min	2 per min
10^{-4}	3 hours	1 per 5 min
10^{-5}	24 hours	-
10^{-6}	2 weeks	-
10^{-7}	4 months	-
10^{-8}	3 years	-
10^{-9}	30 years	-

Leakrate sensitivity of some common measurement methods	
Sniffer	$1{\cdot}10^{-4}$ mbar L / sec
Snoop	$5{\cdot}10^{-6}$ mbar L / sec
He Mass spectometer	$2{\cdot}10^{-11}$ mbar L / sec

Contamination depending on leak rate (mbar L/sec) and flowrate



Dewpoint in function of moisture content
Dewpoint versus H_2O



Single and double stage pressure regulators
Principe of operation

Pressure regulators are used to reduce the high pressure of a gas cylinder or pipeline to the working pressure, which is compatible with the operating equipment and instruments. A regulator only controls the pressure but it does not measure or control the flow, unless it has been equipped with devices which are specially designed for that purpose.

The gas enters the inlet chamber and its inlet pressure gauges towards a valve. The pressure of the gas forces the valve against the seat which ensures complete sealing. This valve separates the inlet chamber from the delivery chamber and is in contact with a flexible diaphragm inside the delivery chamber.

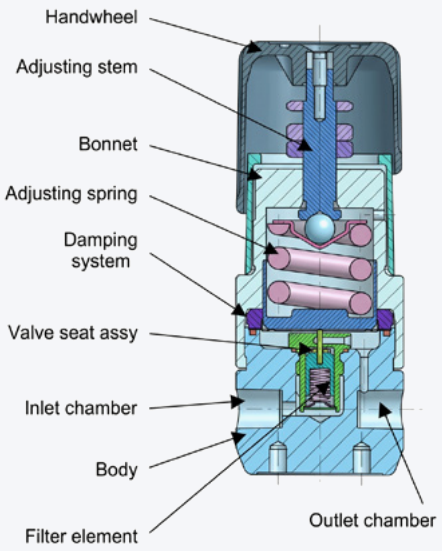
The diaphragm presses against the pressure adjusting spring. This spring is compressed by an adjusting screw. It pushes against the diaphragm, which activates the valve, opening the regulator and allowing gas flow. If the spring is compressed by the adjusting screw to a force which is equivalent to 3 bar, the diaphragm will push the valve open enough to allow gas flow into the delivery chamber at 3 bar.

A delivery pressure gauge is connected to the delivery chamber. By watching this gauge as you turn the pressure adjusting screw, you can set the delivery pressure. In single-stage regulators, there is less force against the valve stem because of a high pressure cylinder which is getting empty. As such, the delivery pressure will slightly increase. This means that frequent manual readjustments are necessary to maintain a constant delivery pressure.

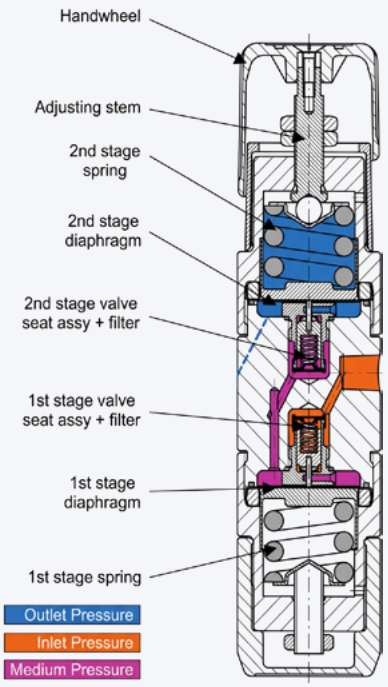
Two-stage regulators are two regulators mounted in series in the same body. The first stage is very similar to the second stage with an inlet chamber, a stem, a diaphragm and a pressure adjusting spring. The spring in the first stage is factory pre-set. The first stage will reduce the inlet pressure to an intermediate stage, usually less than 30 bar.

The second stage reduces the intermediate pressure to the desired working pressure. As the second stage undergoes only minor inlet pressure variations from the first stage, a two-stage regulator maintains a steady outlet pressure throughout the life of the cylinder contents.

Single stage regulator



Two stage regulator



Technical data

Conversion factors

Category	Unit	Value	Equivalent unit
Length	1 Foot (ft)	0.3048	meter
	1 Inch (in)	0.0254	meter
	1 Mile (mile)	1609.4	meter
	1 Yard (yd)	0.9144	meter
	1 Ångström (Å)	10^{-10}	meter
	1 Micron (µ)	10^{-6}	meter
Area	1 Square Foot (ft^2)	0.0929	m^2
	1 Square Inch (in^2)	6.4516×10^{-4}	m^2
Volume	1 Cubic Centimeter (cm^3)	10^{-6}	m^3
	1 Milliliter (ml)	10^{-6}	m^3
	1 Liter (L)	10^{-3}	m^3
	1 Cubic Foot (ft^3)	28.317×10^{-3}	m^3
	1 US Gallon	3.75854×10^{-3}	m^3
	1 Cubic Inch (in^3)	16.387×10^{-6}	m^3
Mass	1 Pound (lb)	0.45359	kg
Prefix values	10^9	giga	(G)
	10^6	mega	(M)
	10^3	kilo	(k)
	10^2	hecto	(h)
	10	deca	(da)
	10^{-1}	deci	(d)
	10^{-2}	centi	(c)
	10^{-3}	milli	(m)
	10^{-6}	micro	(µ)
	10^{-9}	nano	(n)
Pressure	1 Technical Atmosphere (kgf/cm^2)	0.980665	bar
	1 Normal Atmosphere (atm)	1.01325	bar
	1 Pound Force / square inch (psi)	0.068948	bar
	1 Pascal	10^{-5}	bar
	1 Millimeter of Mercury (mm Hg)	1.33322×10^{-3}	bar
Temperature	Degree Fahrenheit (°F)	32 + 9/5°C	-
	Degree Celsius (°C)	5/9 (°F - 32)	-
	Degree Kelvin (°K)	°C + 273.15	-
Concentration	1 part per trillion (ppt)	10^{-3}	ppb
	1 part per billion (ppb)	10^{-3}	ppm
	1 part per million (ppm)	10^{-4}	%

Cylinder information

Cylinder type	External diameter (mm)	Height to outlet axis (mm)	Tare weight (kg)	Water capacity (liter)
50H - 50HQ	229	1530	65	50
20H - 20HQ	210	850	32	20
10H - 10HQ	150	860	17	10
3H - 3HQ	100	480	4.5	2.7
50HA	250	1545	57	50
20HA	204	975	24.5	20
10HA	176	695	13.5	10
5HA	140	565	7	5
2HA	102	415	3	2
LBA	70	255	1	0,5
112L	365	1210	43	112
50L	305	890	26	50
10L	280	330	8.4	11.3
50SSL	230	1420	36	50
10SSL	142	835	14.5	10

H - HH = Steel
HA - LBA = Aluminum
HQ = Steel internally coated - 200 bar working pressure
SSL = Stainless Steel - 10 bar working pressure
L = low pressure - 20 bar working pressure

Dimensions and weights are indicative and may vary by approximately 3%.



Making life better through gas technology

Nippon Sanso Euro-Holding, S.L.U.
info@eu.nipponsanso.com

eu.nipponsanso.com