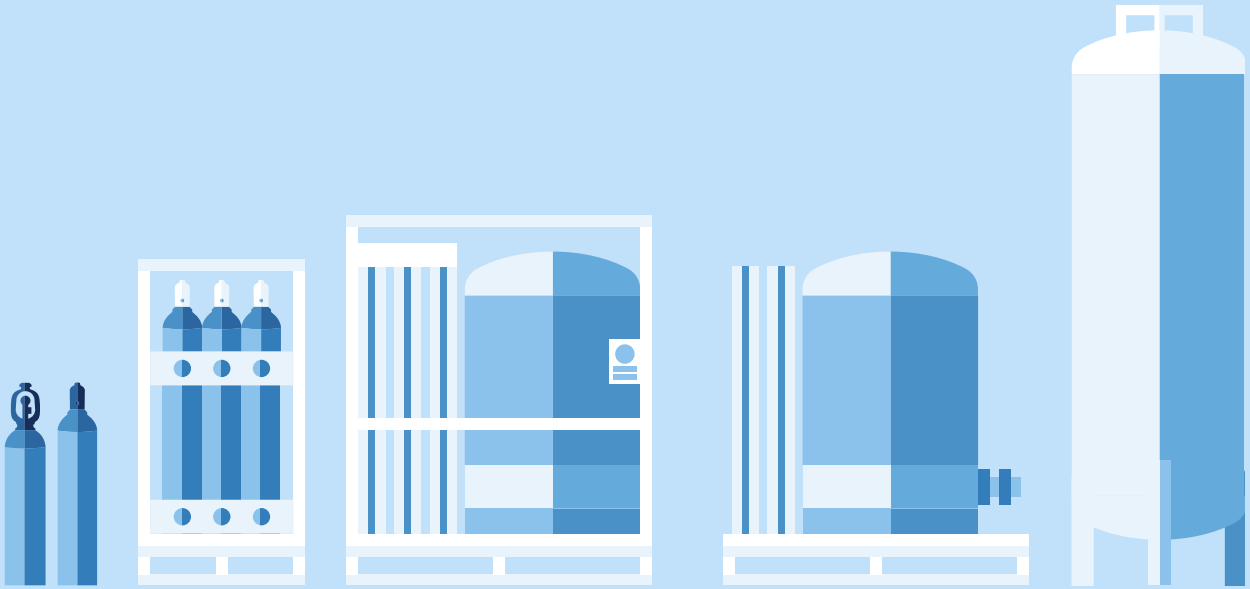
Additive Manufacturing
The right supply has many forms



NIPPON SANSO

Nippon Sanso in Europe

Nippon Sanso is a leading industrial and medical gases company part of Nippon Sanso Holdings Corporation. In Europe, the company's present in 13 different countries, namely Belgium, Denmark, France, Germany, Ireland, Italy, The Netherlands, Norway, Poland, Portugal, Spain, Sweden and the UK. With 4,000 employees,the company is one of the four largest Industrial gas companies in Europe.

Nippon Sanso specialises in providing safe, reliable gas-based solutions tailored to a variety of markets, drawing on technological expertise. Application-oriented advice based on many years of international experience and excellent service are the basis for a trusting customer-supplier relationship.

Nippon Sanso Holdings Corporation

The Nippon Sanso Holdings Group is the world's fourth largest supplier of industrial, electronic, and medical gases, operating in four geographic hubs - Japan, the U.S., Europe and Asia & Oceania - covering over 30 countries and regions. In addition, the Thermos business supplies THERMOS branded products to more than 120 countries around the world.

Since its foundation as Nippon Sanso Ltd. in 1910, the group stands for creating social value through innovative gas solutions that increase industrial productivity and enhance human well-being. With more than 20,000 employees, together, we are "The Gas Professionals" and we all have the same goal: "Making life better through gas technology"

Our presence in Europe		
	4 K	Employees
	30.9%	of which are women
	13	Operational countries
	150K	Customers
	622K	Patients

Reliable gas supply from Nippon Sanso

Separation of ambient air mainly produces N_2, O_2, Ar, but also rare gases (Ne, Kr and Xe).

Gases can be supplied in different ways:

- **Pipeline**
- **Truck/tank**: as cryogenic liquid
- **Cylinders**: compressed gas or directly produced on-site



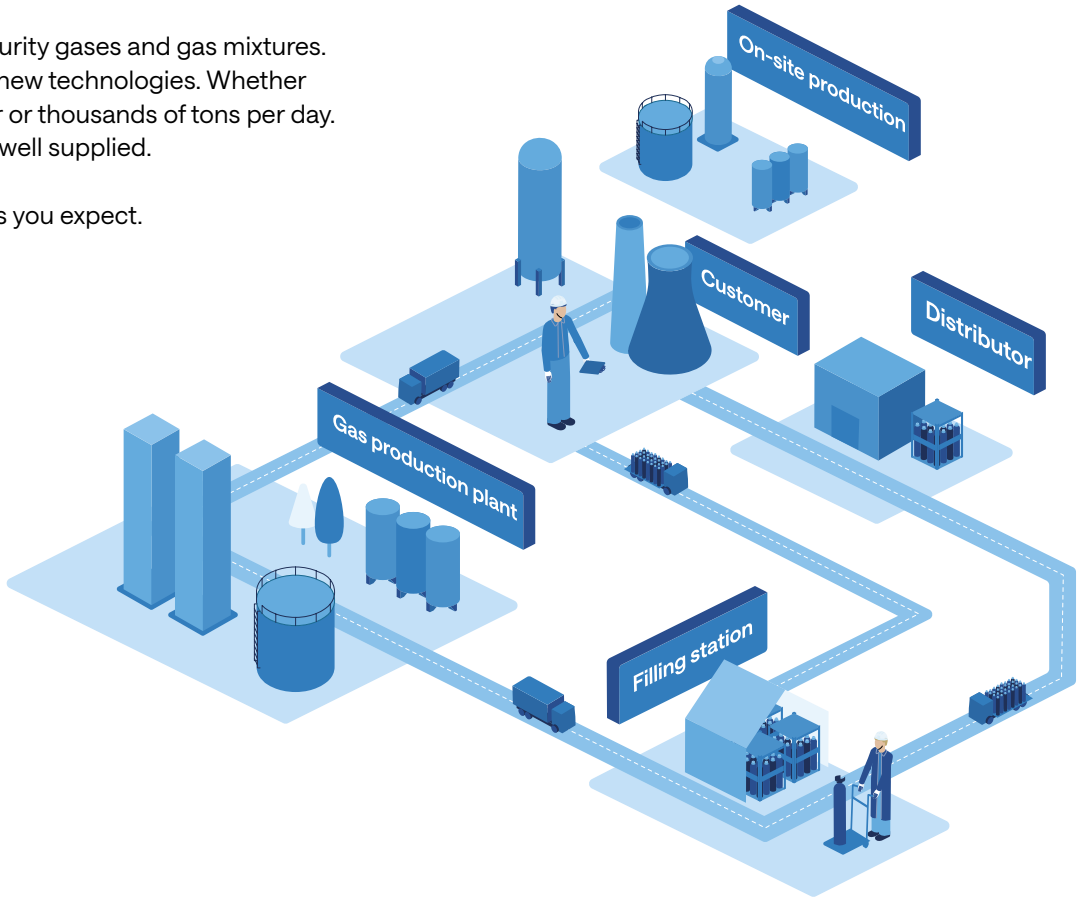
Versatile
Tailor-made gas supply

Gases influence machine performance, process' efficiency and the ultimate quality of end product. It does not matter whether you are producing or researching.

Nippon Sanso's product range includes all atmospheric gases as well as process and specialty gases.
As standard gas or custom-made.

From industrial units to high purity gases and gas mixtures. Ideal for proven processes or new technologies. Whether you need just a single cylinder or thousands of tons per day. With our gases, you're always well supplied.

So that you achieve the results you expect.



Cylinders | The most versatile

Cylinders are the standard for a wide range of shielding gases. Plug&Work® is Nippon Sanso integrated valve. Thanks to their integrated pressure regulator, cylinders with Plug&Work® are not only ready for use in just three steps, but also very easy to operate.

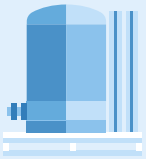
Installation option: indoors



MicroBulk® | The medium ones

These tanks close the economic gap for medium consumption. Suitable for central gas supply systems, the product – Ar, N_2, O_2 and CO_2 - is stored liquified in small tanks. They offer all the advantages of a liquid supply with lower installation and licensing costs. They can be filled on site, and also be connected to gas mixing stations.

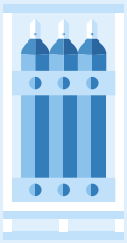
Installation option: outdoors



Bundles | The small ones

Bundles can be connected to the central gas supply. A bundle is about the size of a Euro-pallet and consist of several individual cylinders piped together with a common outlet.

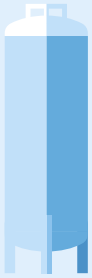
Installation option:
indoors or outdoors



Tanks | The large ones

Vacuum-insulated tank systems are suitable for air gases and connection to central gas supplies. The liquefied product is stored onsite in large quantities.

Installation option: outdoors

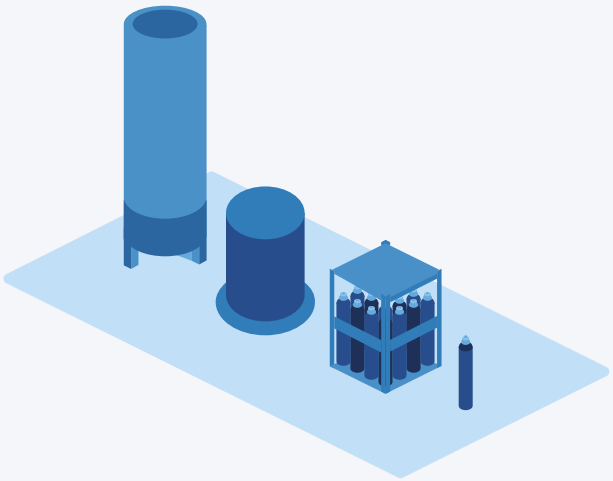


Adequate
Up to the point-of-use

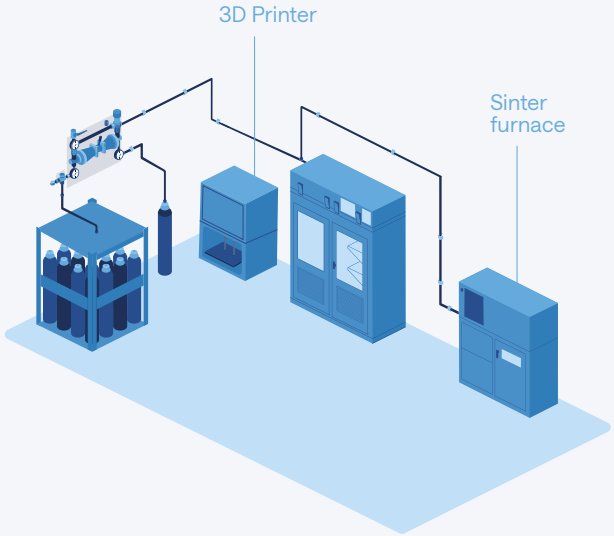
The choice of the right supply solution directly influences operations' safety and quality . Four criteria are decisive here, especially at the point of use:

- Continuous availability
- Required volume
- Purity
- Compliance with legal requirements for gas supply plants

Flexibility to suit customers' needs
Available supply forms



Expertly supply up to the point of use
Configuration example



Nippon Sanso analyses customers' needs based on key questions like:

- Gas supply layout?
- Available installation options/areas?
- Prerequisite for continuous gas supply?
- Material of gas supply line?
- Quality of the tapping/control equipment?

Nippon Sanso's experts support customers from A to Z:

From the choice of form of supply, via the layout of the accessories to the delivery of the gas at the point of use.



Where do gases come from?

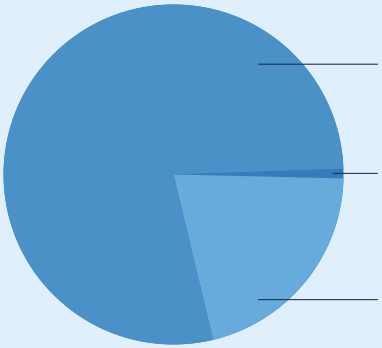
Air

Air is a mixture of several gases. Nitrogen, oxygen, argon, carbon dioxide, water vapor and trace amounts of other elements that make up the atmosphere.

Air Separation Units (ASU)

Air Separation Units (ASU) are industrial plants that separate oxygen, nitrogen and argon from all the other components and liquefy them.

Air gas composition



*Others

Xenon: 0.000009%
Neon: 0.0018%
Hydrogen: 0.00005%
Helium: 0.005%
Krypton: 0.0001%
Carbon dioxide: 0.038%

The air liquefaction

In 1895, a technical method was patented that enables the liquefaction of air and the separation of the atmospheric components oxygen, nitrogen and argon in larger quantities. Since 1902, this method has been used industrially in air separation plants. Today, the separation process is still based on the Joule-Thomson effect: compression, expansion and cooling.

The different boiling points after purification and cooling are used to separate the air into its main components. This primarily involves the separation of liquid oxygen (LOX) and nitrogen (LIN). Liquid argon (LAR) must be generated by an additional process step in a further separation column.



Air separation
Plant types

Cryogenic

Distillation

- Air Separation Unit (ASU/ASP)
- Multiproduct (O_2, N_2, Ar)
- Gas or liquid
- Base plant or onsite
- High purity

Air Separation Unit (ASU/ASP)

- Multiproduct (O_2, N_2, Ar)
- Gas or liquid
- Base plant or onsite
- High purity

N-Plant

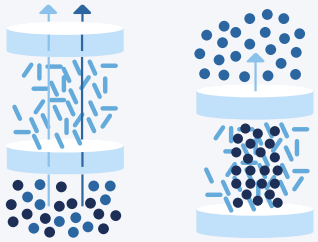
- Single product (N_2)
- Gas supply (no liquid)
- Onsite



- Nitrogen: -196°
- Argon: -185°
- Oxygen: -183°

Non-cryogenic

Adsorption
Adsorbent retains the undesired gases from the compressed air and allows the desired pure gas to pass.



VPSA (Vacuum/Pressure Swing Adsorption)

- Single product (O_2)
- Gas
- Purity < 95 %
- Onsite

PSA (Micro On-site) (Pressure Swing Adsorption)

- Single product (N_2)
- Gas
- Purity < 99,5 %
- Onsite

Air gases properties

Air gases have different liquefaction temperature or boiling points:

Oxygen	-183 °C
Argon	-186 °C
Nitrogen	-196 °C

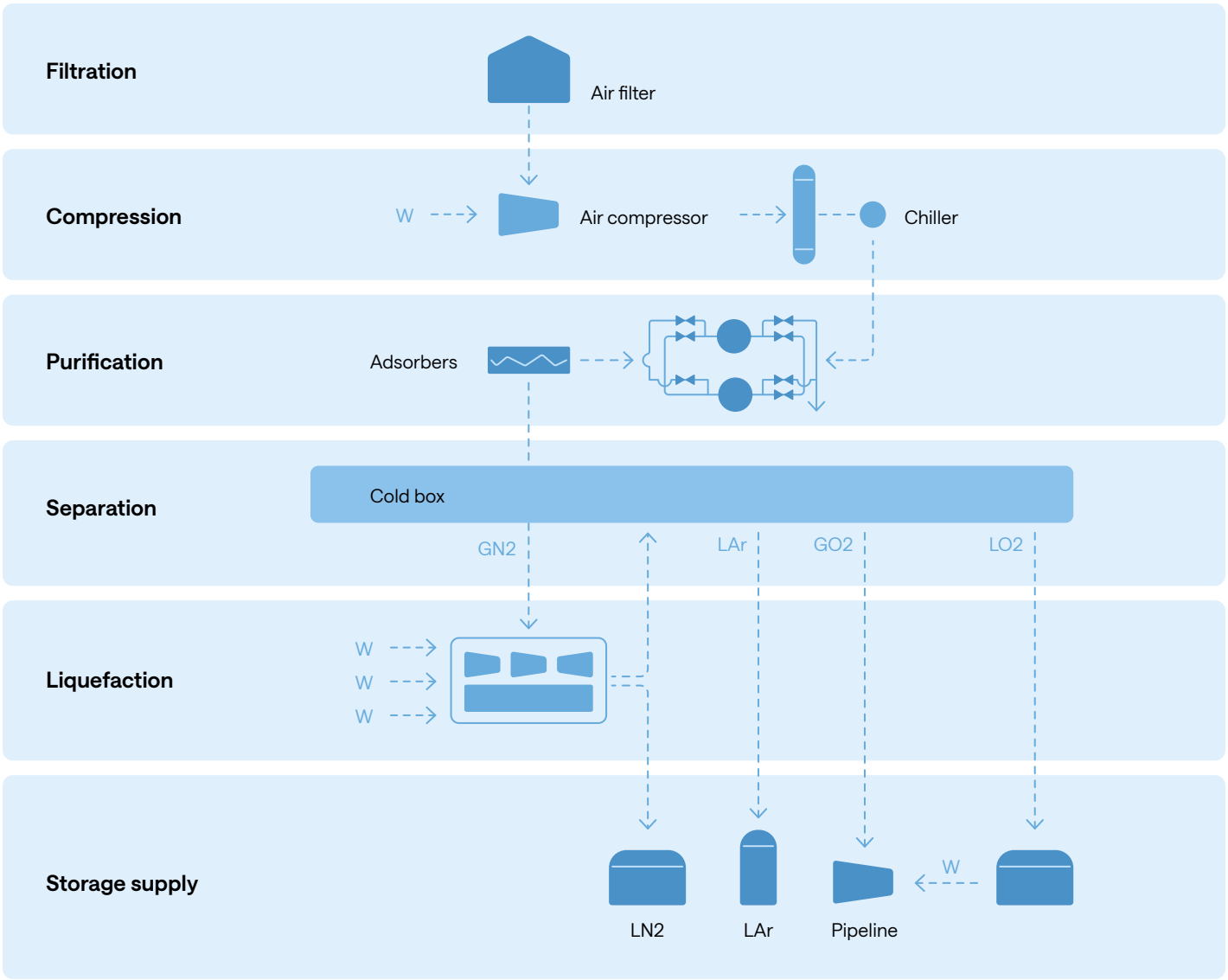
Air gases compression produces gas heating.

Air gases expansion produces gas cooling.

Liquefaction decrease its volumen over 600 times.



Process overview



Air gases

Oxygen (O_2)

Density, gaseous (1 bar, 15°C)	**1.34 kg/m³**
Properties	**Odourless, tasteless, colourless**
Boiling point	**-183 °C**
Extraction	From the liquefaction of air with subsequent distillation
Oxygen in cylinder	10 l, 200 bar / 300 bar 20 l, 200 bar / 300 bar 50 l, 200 bar / 300 bar
Properties	Oxidising Non-flammable Heavier than air
Applications	Flame cutting, heating, straightening For combustion Laser applications with O_2 3.5 Medical gases

Nitrogen (N_2)

Density, gaseous (1 bar, 15°C)	**1.17 kg/m³**
Properties	**Odourless, tasteless, colourless**
Boiling point	**-196 °C**
Extraction	From the liquefaction of air with subsequent distillation
Nitrogen in cylinder	10 l, 200 bar / 300 bar 20 l, 200 bar / 300 bar 50 l, 200 bar / 300 bar
Properties	Inert Non-toxic Non-flammable Lighter than air Main-fraction
Applications	Pressurise, inertise, purge Additive manufacturing Gas mixture for beverage industry, food packaging Lab gas with different purity

Argon (Ar)

Density, gaseous (1 bar, 15°C)	**1.67 kg/m³**
Properties	**Odourless, tasteless, colourless**
Boiling point	**-186 °C**
Extraction	From the liquefaction of air with subsequent distillation
Argon in cylinder	10 l, 200 bar / 300 bar 20 l, 200 bar / 300 bar 50 l, 200 bar / 300 bar
Properties	Inert Non-combustible Heavier than air
Applications	Inert gas welding Additive Manufacturing Lab gas with different purity



Process gases

Helium (He)

Density, gaseous (1 bar, 15°C)	**0.17 kg/m³**
Properties	**Highly flammable**
Boiling point	**-269 °C**

Extraction	From the liquefaction of air with subsequent distillation
Helium in cylinder	3 l to 50 l (200 / 300 bar)
Properties	Non-flammable Colourless noble gas Lighter than air Very high thermal conductivity Noble gas
Applications	Gas mixture for welding Laboratory gas with different purity Laser applications Additive manufacturing

Hydrogen (H_2)

Density, gaseous (1 bar, 15°C)	**0.08 kg/m³**
Properties	**Highly flammable**
Boiling point	**-253 °C**

Extraction	From the chemical industry e.g. chlorinealkali electrolysis. From the oil industry.
Hydrogen in cylinder	Significance in analytics with high purity (200/300 bar). Gas mixture with nitrogen as forming gas (200/300 bar). Gas mixture as welding gas (200/300 bar). Fuel gas in metallurgy (200/300 bar).
Properties	Lightest gas Colourless Odourless Highly flammable
Applications	Lab gas with different purity

Carbon dioxide (CO_2)

Density, gaseous (1 bar, 15°C)	**1.85 kg/m³**
Properties	**Odourless, tasteless, colourless**
Boiling point	**-78 °C**
Extraction	From combustion processes in the chemical industry. From natural sources.
Carbon dioxide in cylinder	Liquid in the bottle below 31°C. At room temperature cylinder pressure approx. 60 bar. Different bottles for gas and liquid extraction (riser tube).
Properties	0.04% in air Non-flammable Heavier than air Good solubility in water
Applications	Beverage carbonation Fire extinguishing agents Medical gases Welding (C18)

Acetylene (C_2H_2)

Density, gaseous (1 bar, 15°C)	**1.09 kg/m³**
Properties	**Highly flammable, colourless**
Boiling point	**-84.7 °C**
Extraction	Made from carbide and water. Synthetic.
Acetylene in cylinder	The bottle contains calcium silicate hydrate as a porous mass. This is impregnated with acetone, which in turn can dissolve large amounts of acetylene.
Properties	Explosion limit: 2.3 - 82 vol.% (air). Water solubility: At 20°C 1 litre ethyne/l water. Other solubilities: Very good in acetone and alcohol.
Applications	Fuel gas

Process gases

Neon (Ne)

Density, gaseous (1 bar, 15°C)	**0.842 kg/m³**
Properties	**Odourless, colourless**
Boiling point	**-246 °C**

Extraction	From the liquefaction of air with subsequent distillation
Neon in cylinder	10 l (200 bar) 50 l (165 / 200 bar)
Properties	Inert Non-flammable Noble gas
Applications	Laser gases for electronics

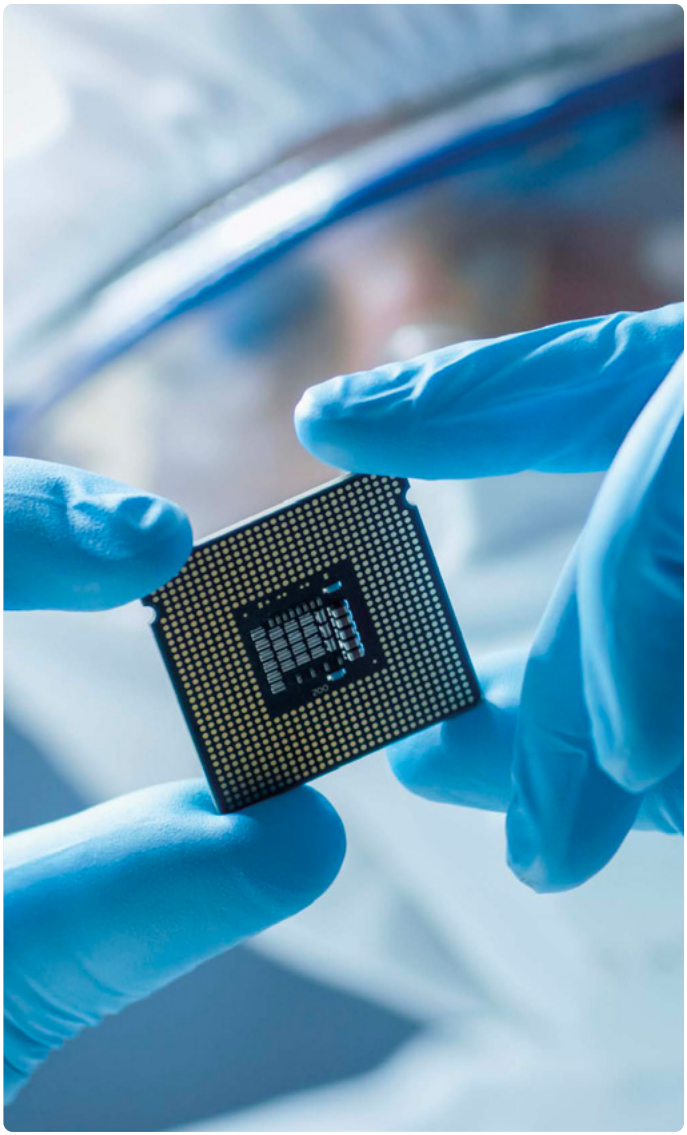
Krypton (Kr)

Density, gaseous (1 bar, 15°C)	**3.51 kg/m³**
Properties	**Odourless, colourless**
Boiling point	**-153 °C**

Extraction	From the liquefaction of air with subsequent distillation
Krypton in cylinder	2 l (82 bar) 10 l (82 / 144 bar) 50 l (144 bar)
Properties	Inert Non-flammable Non-toxic Noble gas
Applications	Gas for lamp fillings Filling for insulating glass Surface treatment for tools Research Laser gases for electronics Ion propulsion for satellites

Xenon (Xe)

Density, gaseous (1 bar, 15°C)	**5.51 kg/m³**
Properties	**Odourless, colourless**
Boiling point	**-108 °C**
Extraction	From the liquefaction of air with subsequent distillation
Xenon in cylinder	2 l (58.4 bar) 10 l (58.4 bar) 50 l (58.4 bar)
Properties	Noble gas Xenon reacts directly with fluorine only
Applications	Gas for lamp fillings Filling for insulating glass Surface treatment for tools Research Laser gases for electronics Ion propulsion for satellites



Properties of cryogenic gases

Conversion table for cryogenic liquefied gases

Oxygen (O_2)	90.2 K -183 °C Boiling temperature at 1 bar	1 m³ 1 l 1 k	^ 1.171 / ^ 0.854 m³ ^ 0.748 m³	^ 1.337 kg ^ 1.142 kg ^ 0.876 l
Nitrogen (N_2)	77.4 K -195.8 °C Boiling temperature at 1 bar	1 m³ 1 l 1 k	^ 1.449 / ^ 0.690 m³ ^ 0.855 m³	^ 1.170 kg ^ 1.808 kg ^ 1.238 l
Argon (Ar)	87.3 K -185.8 °C Boiling temperature at 1 bar	1 m³ 1 l 1 k	^ 1.198 / ^ 0.835 m³ ^ 0.599 m³	^ 1.669 kg ^ 1.395 kg ^ 0.717 l
Carbon dioxide (CO_2)	194.7 K -78.5 °C Boiling temperature at 1 bar	1 m³ 1 l 1 k	^ 1.757 / ^ 0.569 m³ ^ 0.541 m³	^ 1.849 kg ^ 1.052 kg ^ 0.951 l





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

eu.nipponsanso.com