A01 The most important industrial gases – Applications and properties

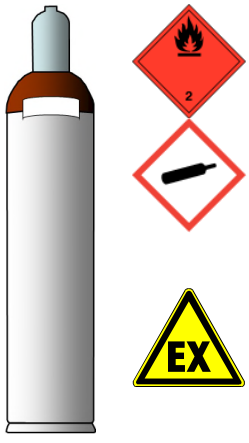
Gas overview (table)

Name	Property / hazards			Delivery form / hazards				
	Inert / non-flammable	Combustible	Oxidising/fire intensifying	Gaseous	Dissolved (in solvent)	Liquefied under pressure	Cryogenically liquefied	Solid
Acetylene		X			X			
Argon	X			X			X	
Helium	X			X			X	
Carbon dioxide	X					X	X	X
Oxygen			X	X			X	
Nitrogen	X			X			X	
Hydrogen		X		X			X	
Propane (butane)		X				X		

Acetylene (C_2H_2)

Properties / manufacture

Acetylene is a colourless, non-toxic fuel gas with a faint odour that is slightly lighter than air (relative density = 0.91). Acetylene is transported and stored in pressurised gas cylinders with a porous filling, dissolved in acetone. The cylinder must therefore be stored upright. It is produced from calcium carbide in acetylene generators or by the petrochemical sector.



Shoulder colour "oxide red" RAL 3009

Main applications

Multi-purpose fuel gas (autogenous welding and cutting process), chemical syntheses, etc.

Safety

Under unfavourable conditions, the energy-rich acetylene molecule can decompose without the involvement of oxygen, thereby releasing energy. This self-decomposition can be initiated when an acetylene cylinder is exposed to high levels of heat or by flashback in the cylinder. The start of decomposition can be detected by the generation of heat in the cylinder.
Acetylene forms explosive mixtures with air.

- Ignition range in air: 2.3 - 82 %
- Self-ignition temperature in air: 305 °C

Argon (Ar)

Properties / manufacture

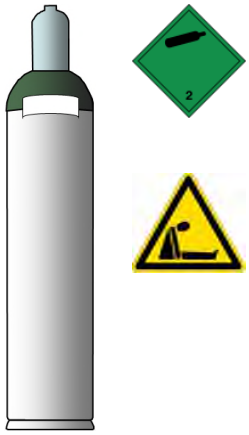
Argon is a colourless, odourless, non-combustible gas, extremely inert noble gas and heavier than air (relative density = 1.78).
Argon is the most common noble gas in the atmosphere (it makes up 0.93 % of the atmosphere) and the third-largest component of air. It is obtained by air separation.

Main application

Shielding gas during welding, degassing of molten metals, filling gas (light bulbs / insulating glass panes), illuminating gas for gas discharge lamps, laser medium in argon-ion lasers, gaseous solvent, food technology, etc.

Safety

Argon is non-combustible. In enclosed areas, breathing air is displaced with no warning symptoms. There is a risk of asphyxiation.



Shoulder colour "emerald green" RAL 6001

Oxygen (O_2)

Properties / manufacture

Oxygen is a colourless, odourless, fire-intensifying, highly reactive gas that is a little heavier than air (relative density = 1.11).
Oxygen constitutes over 50% of the earth, making it the earth's most abundant element. Air is 20.9 % oxygen. It is obtained by air separation.

Main application

Medical breathing gas, welding, cutting, heating and soldering, various laboratory applications, water treatment, food technology, etc.

Safety

Oxygen has an oxidising or fire-intensifying effect. At oxygen concentrations of 35 % and above, the risk of fire increases enormously. All fittings must be kept entirely free of grease/oil, and valves must be opened slowly. Oxygen must be stored separately from combustible substances.

Shoulder colour "pure white" RAL 9010

Nitrogen (N_2)

Properties / manufacture

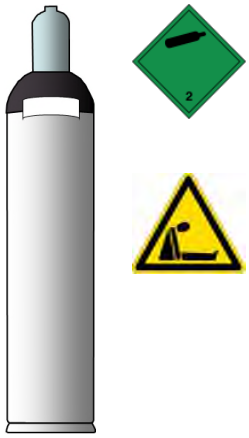
Nitrogen is a colourless, odourless, non-combustible, extremely inert gas that is a little lighter than air (relative density = 0.97).
Nitrogen is the main component of air, its proportion being 78%. It is obtained by air separation.

Main application

Shielding gas (welding / cutting / soldering), laser gas, inertising, measuring technology, gaseous solvent, food technology, etc.

Safety

Nitrogen is non-combustible. In enclosed areas, breathing air is displaced with no warning symptoms. There is a risk of asphyxiation.



Shoulder colour "jet black" RAL 9005

Hydrogen (H_2)

Properties / manufacture

Hydrogen is a combustible, non-toxic gas that is significantly lighter than air (relative density = 0.07) and rises quickly in the event of leaks. It is obtained from water by electrolysis, from oil using chemical methods or from natural gas using the steam-methane reforming process.

Main applications

Shielding gas in the heat treatment of metals, hydration processes in the chemical industry, process gas (electronics industry / food technology), fuel gas for special procedures, fuel cells, etc.

Safety

Since hydrogen rises quickly, the risk of an explosion in the event of discharge is usually short lived (in contrast to liquid petroleum gas). Hydrogen burns with a colourless, almost invisible flame in air.
Hydrogen forms explosive mixtures with air.

- Ignition range in air: 4 – 75 %
- Self-ignition temperature in air: 560 °C

Shoulder colour "flame red" RAL 3000

Helium (He)

Properties / manufacture

Helium is a colourless, odourless, neutral-tasting and non-toxic gas. As the second-lightest gas it is much lighter than air (relative density = 0.18). Helium is produced during the extraction of natural gas (up to 16 %) and oil (0.4 %).

Main application

Coolant (superconductor), welding and laser technology, helium-oxygen mixture as breathing gas (medical and diving), food technology (propellant or packaging gas), lifting gas for balloons and airships, etc.

Safety

Although helium is non-toxic, breathing in the gas or allowing it to be discharged in enclosed spaces is not recommended. Helium displaces breathing air, which can lead to a shortage of oxygen and in the worst case to asphyxiation.

Shoulder colour "olive brown" RAL 8008

Carbon dioxide (CO_2)

Properties / manufacture

Carbon dioxide is colourless and odourless in its gaseous state, it has an asphyxiating effect and is significantly heavier than air (relative density = 1.53). Carbon dioxide can be obtained from natural gas sources and from combustion or fermentation processes of organic substances.

Main application

Drinks industry, fire extinguishing equipment, waste water neutralisation, welding technology, food technology, coolants, etc.

Safety

In addition to the displacement of oxygen in the ambient air, carbon dioxide can have direct negative effects upon the oxygen exchange in our lungs. The direct inhalation of carbon dioxide quickly leads to unconsciousness and can be fatal. Due to its relatively high density, carbon dioxide can accumulate in depressions and low-lying rooms.

Shoulder colour "dusty grey" RAL 7037

Propane (C_3H_8) / isobutane (C_4H_{10})

Properties / manufacture

Propane / isobutane are colourless combustible gases (chemical compounds made up of carbon dioxide and hydrogen). For safety reasons, they are artificially odorised to make them more noticeable. Industrial production takes place as a by-product of oil extraction/oil refinery.

- Boiling point of propane -42.1 °C (corresponds to 8.91 bar at 20 °C)
- Boiling point of isobutane -10.2 °C (corresponds to 3.34 bar at 20 °C)

Main application

Heating and cooking purposes, propellants (aerosols), fuel for combustion engines (LPG), coolant in air-conditioning units, cigarette lighter gas, etc.

Safety

Propane forms explosive mixtures with air (ignition range 1.7 - 9.5 %). A litre of liquid propane produces 703 litres of combustible gas. Leaks can give rise to hazardous accumulations near the floor and in depressions and cellars (1.55 times heavier than air).

Scope of application/delimitation

This document supersedes the existing IGS safety recommendation “Die wichtigsten Industriegase – Anwendungen und Eigenschaften IGS-TS-001/04” (The most important industrial gases – applications and properties IGS-TS-001/04).

Further documents (not exhaustive)

- SUVA publication “Gasflaschen. Lager, Rampen, Gasverteilsysteme” (Gas cylinders, storage, platforms, gas distribution systems) no. 66122.d
- SUVA leaflet “Explosionsschutz - Grundsätze, Mindestvorschriften, Zonen” (Explosion protection - principles, minimum requirements, zones) no. 2153.d
- EKAS directive “Flüssiggas, Teil 1” (Liquid gas, part 1) no. 1941.d
- EKAS directive “Flüssiggas, Teil 2” (Liquid gas, part 2) no. 1942.d
- IGS safety recommendations A02 - A07

Any questions?
We have other documents for you.

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