



Air Liquide – one supplier for
gases, equipment and services

Delivering expertise to Research Centres
and Universities



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We deliver
expertise to
Research
Centres and
Universities


We are your best partner in gas, equipment and services for both private and public Research Centres and Universities

We offer the largest portfolio of products covering every aspect of your needs:

- For gases and isotopes (pure gases, gas mixtures, chemical gases, industrial gases, welding gases).
- All ways of supply modes (cylinders, bulk, generators) as well as the most advanced gas installation/equipment technologies (piping, regulators, gas cabinets, gas detectors).
- A large range of services (from laboratory gas supply design to safety training, sites reviews, maintenance services, gas management and even the full Local Customer Support).

Your benefits partnering with Air Liquide:

- Working with people dedicated to Research Centre and University needs.
- Get access to our worldwide expertise.
- Time saving as Air Liquide can offer you a “one stop shop”.



We strive to meet customer demands as well as driving the development of new products, services and equipment

Specialty Gases

Pure gases

Choosing the right pure gas product for a particular instrument or application can be confusing. Gas selection is simplified by reducing the complex variety of available gas grades down to two levels of purity in our ALPHAGAZ™ product line.

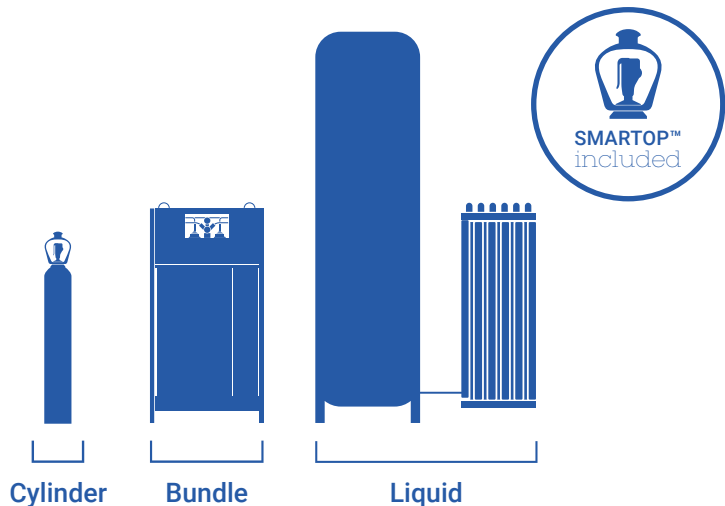
ALPHAGAZ™ – Two grades to ensure your optimal performance

	ALPHAGAZ™ 1 For accuracy of analysis – ranging from % to ppm	ALPHAGAZ™ 2 For high accuracy of analysis – ranging from ppm to ppb
Level of purity	N 50 (99.999 %) ^{***}	N 60 (99.9999 %) ^{***}
Ar - H ₂ - He N ₂ - O ₂	H ₂ O < 2 ppm O ₂ < 2 ppm* CO < 0.5ppm CO ₂ < 0.5ppm CnHm < 0.5 ppm	H ₂ O < 0.5 ppm O ₂ < 0.1 ppm* CO ₂ < 0.1 ppm CO < 0.1 ppm CnHm < 0.1 ppm H ₂ < 0.1 ppm**
Air	H ₂ O < 2 ppm CO < 0.5ppm CO ₂ < 0.5ppm CnHm < 0.1 ppm	H ₂ O < 0.5 ppm CO < 0.1 ppm CO ₂ < 0.1 ppm CnHm < 50 ppb SO ₂ < 10 ppb NOx < 10 ppb
CO ₂ - N ₂ O - C ₂ H ₂	Contact us	
Shelf life	60 months	

*Except for O₂ **Except for H₂ ***N₄₅ for O₂ (ALPHAGAZ™ 1) and N₅₅ for O₂ (ALPHAGAZ™ 2)



ALPHAGAZ™ 1 and ALPHAGAZ™ 2 are available with the best supply modes ensuring safety, quality, consistency and simplicity of use.



Simpler choices

- Two levels of purity to satisfy nearly all of our clients needs
- Optimal number of references
- SMARTOP™ included, the simplest clever valve
- Color-coded cylinder visual identity for easy identification
- Available with a range of compatible gas handling equipment

Quality

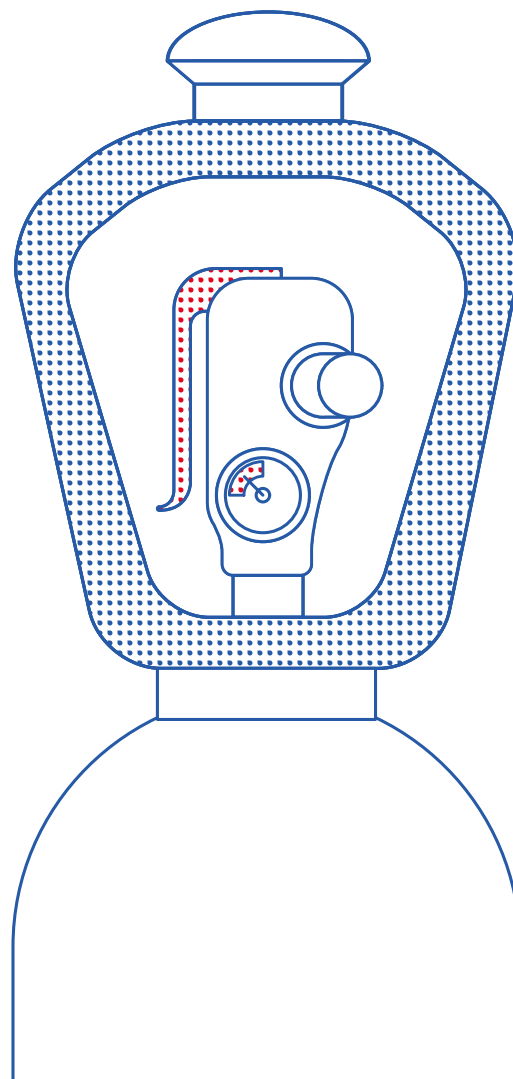
- Guaranteed low level of critical impurities
- Traceability guarantee with a batch number per cylinder
- Specialized cylinder conditioning ensures long-term stability and purity of contents
- Certificate of conformity included

Reliable Service

- Products in stock
- Dedicated customer support from quotation to delivery

SMARTOP™

- Designed for laboratory and analysis applications
- Ergonomic valve for easy operations
- Ergonomic cap for protection



Gas Mixtures

High-performance gases for demanding applications

Air Liquide is a recognized world leader in the production of calibration gases (part of specialty gases) that are engineered to meet a wide range of measurement and process control requirements.



What does *Air Liquide* offer?

- Unique portfolio of different gas mixture classes that allow a perfect match between the product performance and the application needs.
- The mixtures are characterized by the degree of accuracy, level of traceability, blend tolerance, process accuracy, analytical accuracy and other critical parameters.
- Leading-edge technology to produce highly accurate and stable gas mixtures containing component concentrations as low as parts-per-billion.
- Computerized and automated high-precision specialty gas filling system to achieve consistent, high-accuracy gas mixtures.
- Specialty gas labs that are ISO 9001 registered and selected plants that are ISO/EC 17025 and 17034 accredited.
- Large network of laboratories, filling locations, service locations, regional specialty gas labs, equipment centres and research & development centres.

Standard Mixtures

Air Liquide manufactures standard mixtures for various applications:

- Environmental Monitoring
- Gas Detection
- Appliance Testing
- Food & Pharma
- Engine Emission Testing
- Research & Development
- Oil & Gas Measurements

Products

Products are offered in standard cylinders suited for laboratory applications. For off site analytical and monitoring requirements, that are not confined to the laboratory applications, we have available small, refillable and non-refillable cylinders equipped with cylinder valve, pressure regulator and flow meter.



Custom Mixtures

Technical personnel will work with you to engineer your custom designed mixture to meet your exact application needs. A large selection and combination of components, concentrations, balance gases and container options are available for:

- Specialized customer requirements
- Developmental and exploratory mixtures
- Products with mixed blend and accuracy specifications, by component

Design your Custom Mixture:

Custom mixtures can be manufactured in both gas and liquid phases, using inert, non-atmospheric and hydrocarbon balance materials. It allows you to select the mixture specifications – blend tolerance, analytical accuracy, process accuracy and reproducibility – that meet your application

requirements. You may also determine the traceability of your mixture and referencing materials to be used, which can include your own internal standards. It also offers you the greatest amount of flexibility in the design of multi-component mixtures.



We keep it simple

- Clear and concise certificate of analysis
- Direct access to gas experts from our expertise centre for advice and quick quotation
- Transparency on accuracy and traceability of true value
- Easy to order

LABTOP™

Cutting edge simplicity

ALPHAGAZ™ mixtures* feature an advanced built-in regulator which will transform your calibration experience.

**Depending on the calibration mixture and country.*

Advanced built-in regulator

- Zero exposure to high pressure gas flow thanks to the integrated regulator.
- Easy actuation and status indication with the 1/4 turn on/off hand wheel.
- No need to purge the regulator to ensure the quality of your analysis.

Ergonomic and shock-absorbing cap

- Total safety ensured by permanent and reliable protection of the valve and the regulator.
- Newly designed cap for easy access during valve's operations, and easy handling of the cylinder.

New On/off hand wheel

- Immediate gas cut-off for increased safety.
- At a glance on/off status.

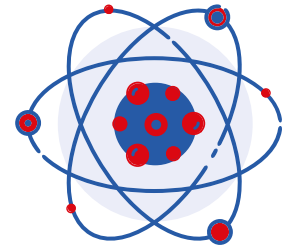
Built-in
regulator



Isotope gases

Stable isotope ratio reference gases

Stable isotope gas mixtures enhance reliability of analysis with precise calibration when it becomes critical to measure delta values accurately.



What are the *benefits*?

- Stable isotope ratio reference gases with an isotopic composition customized for each of your products.
- You will rely on Air Liquide reference gases to provide more reliable analysis.
- Time saving: more efficient calibration of equipments used for stable isotopes analysis.

Isotopic Analysis

Air Liquide offers stable isotope ratio reference gases with high analytical accuracy, required compositions, and targeted isotopic signatures. The five most commonly used elements (C, O, H, N, and

S) in stable isotope research are currently available with a large range of isotopic ratios. Air Liquide provides these gases in cylinders with sizes adapted to your needs.

Air Liquide stable isotope ratio reference gases are categorized into two groups: **standard products** and **custom products**

- Standard products are “ready to be shipped and in stock”.
- Custom products with customer specific molecular and isotopic composition (from ppm to %) that can be designed upon request.

If a specific gaseous reference material with an isotopic ratio is required, Air Liquide is here to satisfy your unique requirements. Together we find the best possible solution for your business.



Stable isotope reference materials for specific applications:

- **EARTH SCIENCE & ENVIRONMENT**

Isotopic signatures for comprehensive understanding of pollution sources.

- **FOOD AUTHENTICATION**

Isotopic analysis to track the origin of Food.

- **PETROLEUM GEOCHEMISTRY**

Isotopic analysis to support accurate exploration and production development planning.

- **MEDICAL DIAGNOSTICS**

Stable Isotopes to support Breath Testing for fast, accurate and noninvasive testing of diseases.

Air Liquide is constantly evolving and as a leader in the industry we always strive to create new interesting and efficient offers.

Proficiency Testing Programs

We provide an opportunity to assess the accuracy of your own measurement through comparison with other participating laboratories.

What are the benefits?

- High degree of confidence of your laboratory analysis.
- Identification of potential problems in the accuracy of analysis.
- Improves credibility of your analytical laboratory capabilities.
- Identifies potential analytical problems.
- Provides quality comparison of participants.
- Proficiency reference gas mixture can be retained as high-confidence master calibration standard.



Chemical Gases & Electronics Materials

Air Liquide offers a range of packaged gaseous chemicals such as ammonia, carbon monoxide, ethylene, hydrogen chloride, sulphur dioxide, sulphur hexafluoride and many more, which are available in different purities.

Electronics specialty materials

Semiconductor, photovoltaic cell and flat panel research require reliable supplies of high-purity process gases and chemicals, also called electronics specialty materials.

Electronics advanced materials

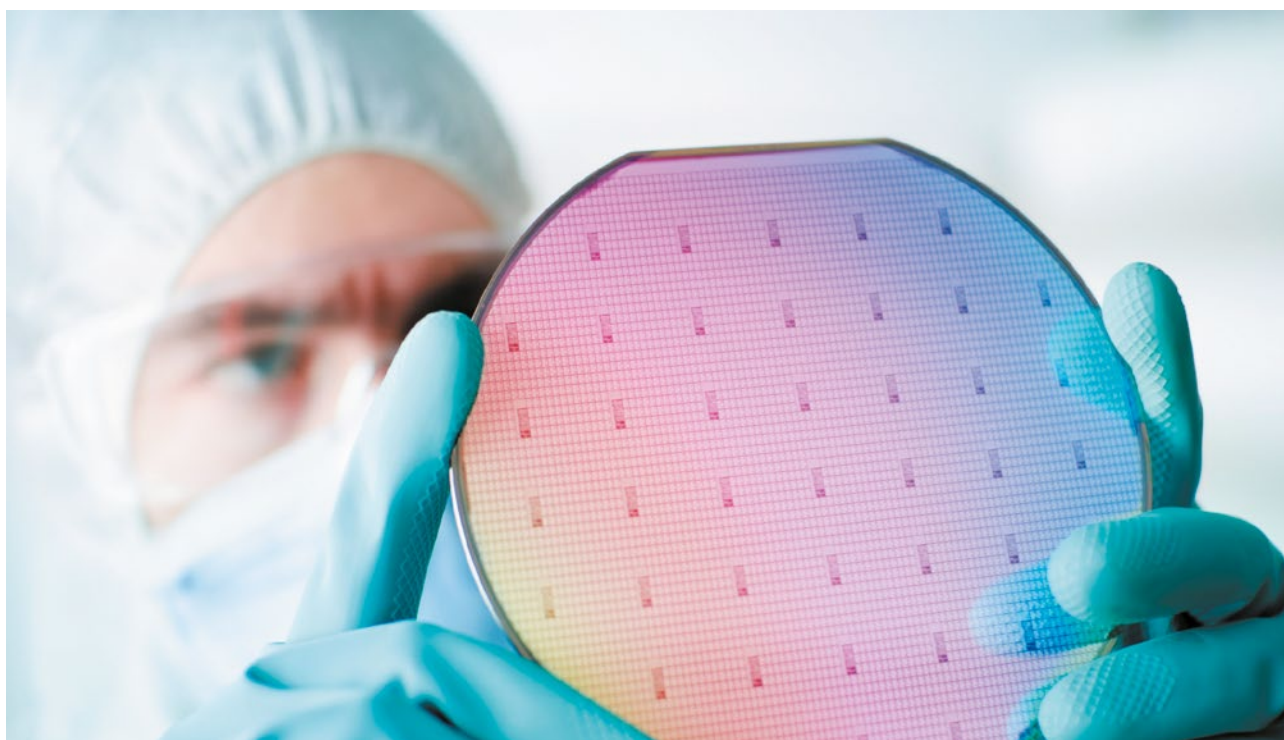
Forming very thin layers of various materials (such as silicon or metals) requires acute control over the deposition and structuring of the material.

We offer a complete range of electronics advanced materials (also called precursor molecules).

Air Liquide is the industry leader in advanced thin-film materials, offering the ALOHA™ and Voltaix™ product lines as part of our material portfolio. Voltaix™, a 100% Air Liquide company and the recognized world

leader in silicon, germanium and boron chemistries, has reinforced our positioning. We have extended our range of advanced precursors, strengthened our relations with key customers and partners, and created new synergies in the research and industrialization of electronics advanced materials.

Our materials offer covers a broad range of advanced deposition processes, ranging from low-k to high-k and from metals to barrier films.





We offer a complete range of electronics advanced materials

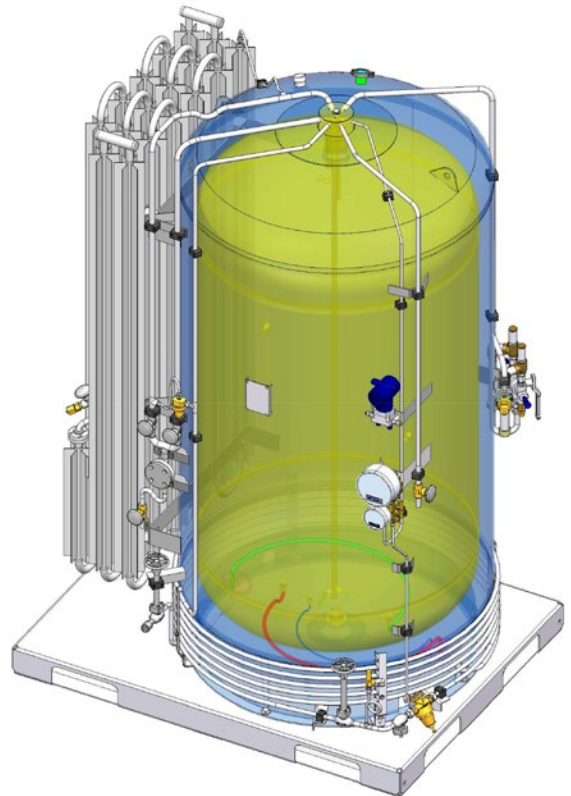
Cryogenic Gases

Proven expertise in supply of liquid gases

Our strong track record for reliability is built upon our local presence and strategically located production facilities. We draw upon our logistics, tank telemonitoring and service capabilities to create premium bulk supply offers tailored for our customers.

We install and maintain the storage, evaporation and pressure control equipment and we guarantee the functioning, quality and safety of these installations during the entire contract term. For gas consumption ranging from ~400 to ~4,000 m³/month we offer compact air gases cryogenic vessels (Skid Tank solution with small tank and vaporizer integrated on one single skid).

For larger consumptions we offer standardized solutions with cryogenic storage tank, vaporizer(s) and pressure control equipment. All solutions with telemonitoring and data logging options.



Liquid to gas

Oxygen, nitrogen and argon are produced and liquefied in air separation units. These products are stored at the production facility and then delivered directly to customers in insulated cryogenic tankers.

Cryogenic Bulk installations typically consist of:

- One or more cryogenic storage tanks, with telemonitoring.
- Vaporizers to transform cryogenic liquid to gas, using heat sources such as ambient air, water or steam.
- Optional: With the unique ECO chiller range the cold extracted from this transfer from liquid to gas can be used for other cooling purposes. This saves both the environment as well as reducing costs.
- Optional: Pressure regulation equipment.



Dry ice & Pellets

Dry ice is the solid form of carbon dioxide or CO₂. As dry ice sublimates, it goes straight from solid phase to gas phase, without leaving any residue. The temperature of dry ice is -78.5°C and is therefore extremely suitable for use as a refrigerant for all kinds of purposes, such as cooling agent during transport.

Dry ice is available as pellets, slices or blocks and delivered in insulating packaging from 5 to 400 kg per box.

ICS Dry Ice (an Air Liquide subsidiary) takes total control for shipment of your time and temperature sensitive samples, including collection at your site, the isothermal packaging or Dry-shipper, the correct amount of cold sources (Liquid nitrogen, Dry-ice, gel packs or PCM's), labelling/classification, handling, air freight, support on your export documents and the delivery door-to-door.

Welding Gases & Industrial Gases

Argon and argon mixtures are the most used shielding atmospheres for arc welding. With ARCAL™ New Generation, Air Liquide has developed the best innovative supply solution to cover all welding situations. ARCAL™ offers 4 ready-to-weld products to make arc welding easier, safer and to improve quality. ARCAL™ has got 4 optimal gas compositions for all supply modes,

from packaged cylinder gases to cylinder bundles and even minibulk installations, depending on the volume needed.

Additionally, ARCAL™ cylinders are available with brand new cylinder heads, such as SMARTOP™ and EXELTOP™, two innovations which have brought the arc welding cylinders into the 21st century.

With SMARTOP™ simplify your gas cylinder use



GAIN PERFORMANCE

Intuitive to use - ensures accurate and stable gas flow.

SAVE GAS

No gas loss thanks to the on/off lever – check content at a glance with the permanent pressure gauge.

WORK SAFELY

Emergency cut-off – Protected valve – no more exposure to high pressure gas flow.

With EXELTOP™ focus on your own performance



SAVE TIME

Fast cut-off the gas with the on/off lever – easy handling thanks to ergonomic cap.

SAVE GAS

No gas loss thanks to the on/off lever – check content at a glance with the permanent pressure gauge.

WORK SAFELY

Emergency cut-off – Protected valve – no more exposure to high pressure gas flow.



ARCAL™

- Prime
- Chrome
- Speed
- Force

Ready-to-use shielding gas solutions


	All materials	Aluminum and copper	Stainless steel	Low- and non-alloy steel	
Welding process	TIG / PLASMA	MIG	MAG / Pulse	MAG	
Benefits	Wide range of applications		Especially for stainless steel	High productivity	Thick material and high tolerance
Specification	Argon, purity $\geq 99,998\%$		Ar + 2% CO ₂	Ar + 8% CO ₂	Ar + 18% CO ₂
Product	ARCAL™ Prime		ARCAL™ Chrome	ARCAL™ Speed	ARCAL™ Force



- High purity
- Perfect surface
- High flexibility



- High welding speed
- Clean end result
- Less after work
- High automation



- Clean weld – high performance
- Cost-effective
- Low oxidation

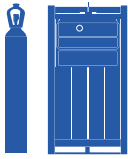
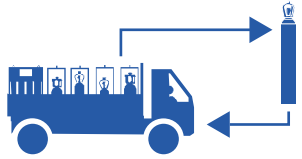



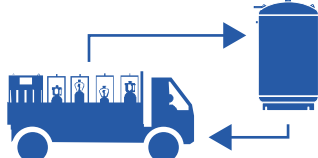
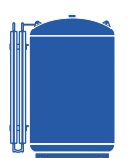
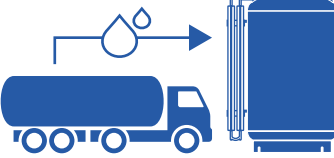

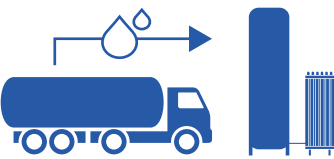


- Good penetration
- Good welding economy
- Less preparatory work

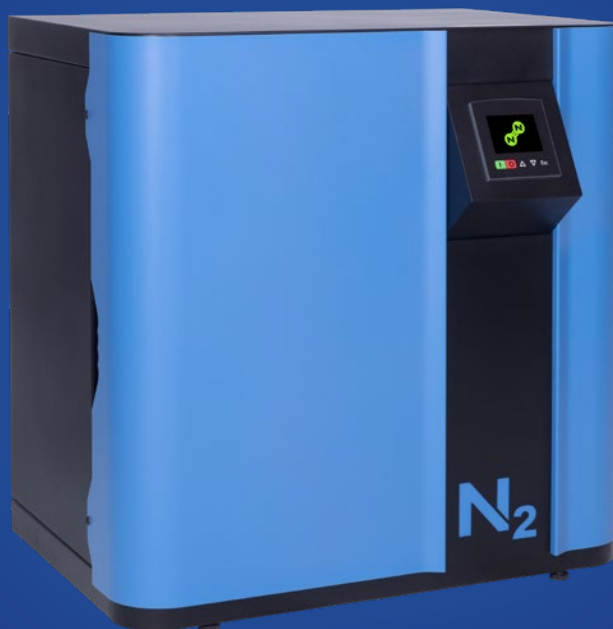
Modes Of Supply

We offer you the most appropriate mode of supply for any volume, meeting your needs in terms of supply reliability, simplicity, quality and costs.

What are the *benefits*?

Supply mode family	Supply mode	Container description	Container size	Delivery mode
Packaged gases for < 5,000 - 20,000 m ³ /yr	Cylinder & Bundles 	Cylinder & Cylinder packs	2 - 240 m ³ @ 200 - 300 bar	Exchange Full-For- Empty 
	LGC 	LGC Liquide Gas Container (Rangers)	~ 180L - 630L	Full-For-Empty or On-Site Refill with Cryo Express 
Mini Bulk	Mini-Bulk for ~ 5,000 m ³ /yr 	LGC 's / Rangers	180L - 630L	Exchange Full-For- Empty 
	Mini-Bulk for ~ 5,000 - 50,000 m ³ /yr 	Small palletized liquide tanks (with integrated vaporizer)	< 3,000L	On-Site Refill 
Bulk	Bulk for > ~10,000 m ³ /yr 	Fixed liqued vessle (with vaporizer plant)	~ 3,000L - 65,000L	On-Site Refill 

ALPHAGAZ™ Flo On-Site generators



The Air Liquide ALPHAGAZ™ Flo range of gas generators is specially designed for use in laboratory environments. Our generators are safe, reliable, compact, low noise and

avoid the logistics and hassle of changing cylinders. Air Liquide takes care of the installation and maintenance of the system.



What does it include?

- ALPHAGAZ™ Flo H₂: Hydrogen generators, electrolysis of water, H₂ purity up to 99,99995%, pressure up to 6.9 bar.
- ALPHAGAZ™ Flo AIR: Zero Air generators, with or without compressor, air purification down to < 0.05 ppm CnHm.
- ALPHAGAZ™ Flo N₂: Nitrogen generators with or without air compressor, N₂ purity up to 99,999%, capacity up to 54 l/min, pressure up to 7 bar.

Equipment & Installations

We provide complete specialty gases handling equipment and distribution systems to supply gases for your entire laboratory.

Our installation design service covers every aspect of gas supply systems from a simple regulator or valve through to a complete turn-key gas piping installation. Whether you require a retrofit to your existing laboratory operation or a brand new laboratory scheme

air liquide can provide the ultimate solution for your gas supply system.

Tailored towards your needs, our priority is to ensure safety in both, design and material / component selection. Our flexible approach for working with our clients provides a new level in customisation and project management.

Installation Enquiries

Following your initial enquiry

- Air Liquide will arrange a site visit to identify and agree your expectations.
- We will guide you through the process to ensure you are confident with how the project will be handled from start to finish.
- The site discussion is tailored to your needs with suggested solutions to optimise the system specification within your budget scope and schedule.



Topics covered during the site visit:



Your requirements:

- Safety
- Pressure requirements
- Gases to be used
- Flow
- Purity
- Pressure/flow control equipment/pipelines



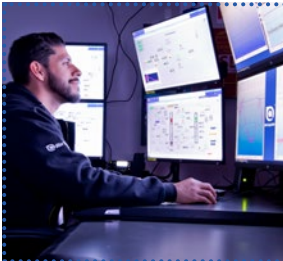
Installation design:

- Site layout and environment
- Connection to your equipment or "Point of Use"
- Mode of supply (bulk liquid, cylinders, gas generators)
- Compliance with latest codes of practice and best practice (including cGMP)
- Pipeline sizing and possible distribution routes



Selection of materials:

- Equipment specifically selected to produce the optimum result in terms of safety, performance and purity.
- Safety devices
- Material compatibility
- Pipeline material options
- Pressure control method



Programming:

- Every effort is made to fit our installation program to your schedule.
- We ensure your systems will be handed over fully tested, commissioned and ready for use.



Project control:

- Project Management by Air Liquide in conjunction with your nominated personnel.



Completion: Training

- Upon project completion your staff will receive training on the safe use of the systems.

ALIM 2 gas cabinet:

Safe and affordable solution for specialty and pure gases distribution.

We offer you the best solutions in terms of engineering, manufacturing, piping and qualification of innovative solutions for fluid distribution, process control and related services.

ALIM 2 for Research Centres and Universities:

- Heat treatment (NH_3)
- Glass (SO_2 , SiH_4)
- Pharma/biotechnologies (HCl , NH_3)
- Laser application (Mix F_2)
- Advanced material / Nanotechnology (SiH_4 , H_2S)
- Photovoltaic (SiH_4 , NF_3 , NH_3 , B_2H_6 , PH_3)
- Photonics (NH_3)
- Semiconductor



What are the benefits?

- Simplest design to ensure safe operations
- Necessary and sufficient for an optimized solution
- Manufactured to the same standard as used in the ultra high purity industry
- Clean room manufacturing process
- Helium leak tested
- Components qualified over 40 years of experience in gas cabinets manufacturing

Packaged solutions for CO₂ SFC

Air Liquide's patented solution for the supply of Liquid CO₂ at the point of use for Supercritical Fluid Chromatography applications (Chiral Separation).

We offer complete package systems for:

- Analytical Scale
- Semi-Prep Scale
- Full Prep Scale
- Large Scale (production)

Insulated / heated enclosures

- Fully automated
- PLC control for heating, pressure, weight and change over
- Delivery of monophasic Liquid CO₂ from SK450 multiple cylinder packs
- Air Liquide patented technology
- No pump needed
- Turn key solution

The full offer includes CO₂ guarantee at point of use in terms of supply continuity and CO₂ quality.

Why CO₂?

- CO₂ reaches supercritical state at 31.1°C and 73.8 bar (its physical state can be easily manipulated)
- CO₂ is non toxic, non flammable
- CO₂ is chemically pure, stable and non-polar solvent
- CO₂ is compatible with LC detectors
- CO₂ is a green solvent

Services

We provide the largest range of services towards both private and public R&D centres and Universities. Our services reflect Air Liquide's worldwide expertise on safety and gas supply management. It will bring researchers peace of mind, regarding being compliant with legal obligations, and it will also generate cost reduction.

Air Liquide's services will meet the expectations, by adding value and improving

efficiency of the day-to-day business inside a laboratory. Analysts and researchers can focus again on the core activities and they will not have to spend their precious time on gas inventory management, selecting the right equipment for the right application or making sure that the equipment is functional and ready for use. You can fully rely on Air Liquide to provide a safe and clean environment for your operations.

ECO ORIGIN™

ECO ORIGIN™ offers you low-carbon industrial gases, including CO₂ itself. Because of the very nature of CO₂, its contribution to the greenhouse effect depends entirely on how it is produced. Air Liquide works with a European network of sources using the decomposition of biomass to produce CO₂: it is then called "biogenic". Biogenic CO₂ is part of the planet's natural carbon cycle, so it does not contribute to greenhouse gas emissions - unlike CO₂ produced by burning fossil fuels.



Our services are modular, which means you can pick those which are best fitting with your specific situation:

Local Customer Support (LCS)

LCS is Total Gas Management of the complete laboratory (or even campus) integrating all the site logistics regarding liquid and packaged cylinder gases with Air Liquide's supply chain, going from inventory management to gas ordering to

cylinder connection. It includes auto-supply, maintenance and professional reporting. The LCS service is a true partnership since one will witness all the benefits of Air Liquide's expertise.

Safety

- Training of laboratory staff.
- Continuous Hazardous Gas Monitoring of the ambient atmosphere inside the lab (detection of O₂ concentration to prevent asphyxiation, detection of toxic gas, detection of flammable gas, monitoring LEL).
- Leak control of the existing gas distribution installation and piping.
- Review of the lab and the gas distribution system by an Air Liquide expert in research and analysis regarding safety & environment and/or gas management (to reduce total cost of ownership).

Gas supply and ordering

- Auto-supply of liquid gases and/or packaged gas cylinders using modern telemonitoring solutions.
- Cylinder hook-up and connection done by Air Liquide logistics while replacing empty with full, fresh delivered gas cylinders.
- Extended delivery to the point-of-use (e.g.: at the top floor of a building), going beyond the regular drop-point.
- Cylinder tracking in real-time for a more efficient inventory management and easy environmental reporting.

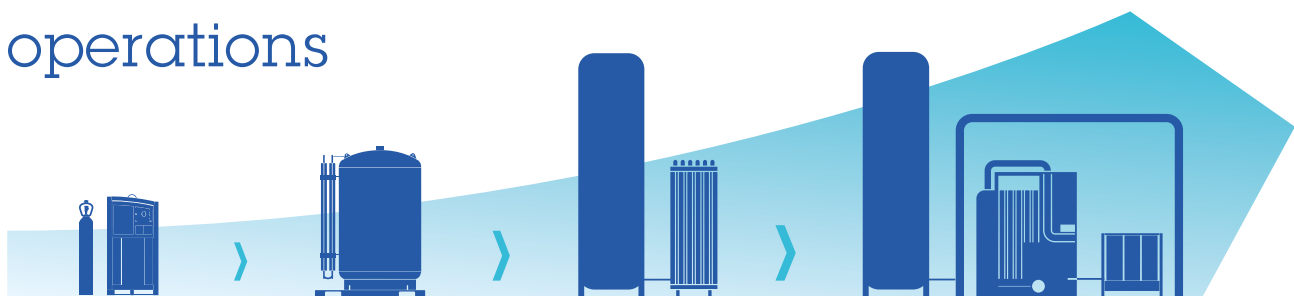
Maintenance services

- **SERVIGAS™ 1** for periodic preventive maintenance of gas handling equipment in the lab.
- **SERVIGAS™ 2** adds spare parts and curative maintenance visits by Air Liquide technicians to the Servigas 1, without piling up repair invoices since travel expenses and labour costs are already included.
- **SERVIGAS™ 3** offers all services covered under Servigas 2 together with the financial benefits of tailor-made gas handling equipment rental solutions.

Services overview

	Packaged gases	Cryogenic liquid gases	Gas handling equipment
Safety services	Training & Audit Safe cylinder manipulation Safe cylinder storage	Training & Audit Handling cryogenics	Training & Audit Leak detection
Gas ordering and supply services	Cylinder tracking ("Servitrax") Extended delivery to the point of use	Gas ordering ("myGAS")	-
Maintenance services	-	-	SERVIGAS™ 1 (Preventive) SERVIGAS™ 2 (1 + curative + preventive) SERVIGAS™ 3 (2 + rental of equipment)
LCS: Local Customer Support	Total gas management - integrating all customer's gas site logistics with Air Liquide supply chain, from inventory management to ordering to connection at point of use		
ECO ORIGIN™	-	ECO ORIGIN™ contributes to reducing the overall carbon footprint.	-

Rely on Air Liquide to provide a safe and clean environment for your operations





Peace
of mind ✓
gas inventory
management
system



Contact us

We are happy to support all your gas activities.

If you have any questions, don't hesitate to contact our experts. You can get in touch with our customer service from 8AM to 5PM:



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A world leader in gases, technologies and services for Industry and Health, Air Liquide is present in 72 countries with approximately 67,800 employees and serves more than 4 million customers and patients.