

# Worry-Free Gas Supply and Solutions for the Pharmaceutical Industry



When you are responsible for discovering and producing drugs, you should not have to worry about your supply of medical and industrial grade gases. We understand your commitment to the healthcare professionals and patients who use your products. And we understand many of the issues you face, including tighter budgets, tighter FDA regulations, and intense competition, whether you are producing drugs, generics, active ingredients or specialty chemicals . . .



With an excellent on-time delivery record, outstanding safety performance and medical gas compliance, and a total solutions approach to doing business, Air Products provides worry-free supply of products and services that can help reduce your risk of noncompliance or downtime and lower your overall operating costs. So you can focus on making the world healthier.

### Put your confidence in our commitment to quality — and compliance

At Air Products, we know that medical grade gases are not an industrial commodity or utility. Lack of compliance with manufacturing, distribution, storage, and usage requirements could put your company at risk.

We have developed a comprehensive program designed to provide reliable, cost-effective, worry-free service to you. We manufacture our medical gases to meet all regulatory standards for production and transport:

- Our purity specifications comply with United States Pharmacopeia (USP), National Formulary (NF), and European Pharmacopeia (EP).
- All our manufacturing sites are fully validated and operated under current Good Manufacturing Practice (cGMP) guidelines (GMP in Canada).
- Our manufacturing process is ISO 9001:2008 certified.
- Our compliance process covers production and storage, trailer loading, distribution, and customer tanks and vaporizers.
- Tankers are dedicated to medical grade service, so we can respond quickly without concern for cross-contamination.

### Relax knowing we have an unrivaled delivery record

Whether you require medical or industrial grade gases, you can relax when it comes to dependable product supply. Air Products works around the clock to maintain its **excellent on-time delivery record** — the best in the industry.

How do we do it?

- We have around 120 production facilities across Asia, in which more than 50 are in China.
- We are the world's largest supplier of hydrogen and helium.
- Asian deliveries are scheduled from our world-class logistics center, where we forecast deliveries using our proprietary software and remote TELALERT telemetry

systems. Ordinarily, there is no need for you to place an order. Our logistics center can help you lower inventory control and reporting costs and minimize delivery truck traffic at your facility.

- A comprehensive range of supply modes, including bulk, microbulk, and on-site generation, enables us to provide the right option to meet your needs.
- Air Products Express (APEX) Services is available for fast, flexible temporary gas supply. Many mobile units are NF certified for medical use, reducing downtime.
- Our Customer Service Center is available 24/7 to help you with your gas and equipment service needs.

### Specifications for Air Products' NF, EP, and USP Grade Gases

	NF Nitrogen	EP Nitrogen	USP Oxygen
<b>Total purity</b>	≥ 99.0%	≥ 99.5%	≥ 99.0%
<b>Oxygen</b>	≤ 1.0%	≤ 50 ppm	
<b>Carbon monoxide</b>	≤ 0.001%	≤ 5 ppm	Exempt*
<b>Carbon dioxide</b>		≤ 300 ppm	Exempt*
<b>Water</b>		≤ 67 ppm	
<b>Odor</b>	None	None	None

\*Carbon monoxide and carbon dioxide exempt due to production by air liquefaction.

## Air Products Offerings Benefit a Number of Applications and Needs

Applications/Needs	Air Products' Offerings
Combustion	<b>Oxygen enrichment systems and modeling expertise</b>
	<ul style="list-style-type: none"> <li>Enhanced combustion and increased productivity</li> <li>Reduced emissions</li> </ul>
Cryopreservation	<b>Liquid nitrogen for cryopreservation and storage of biological materials</b>
	<ul style="list-style-type: none"> <li>Consistent freezing below the glass transition point, <math>-132^{\circ}\text{C}</math></li> <li>Maintains long-term viability of cell structure</li> <li>Reliable long-term storage, not susceptible to electrical outages</li> </ul>
	<b>Oxygen enrichment and modeling expertise</b>
Fermentation	<ul style="list-style-type: none"> <li>Reduced foaming and gas flooding</li> <li>Can improve yields up to 50%</li> </ul>
	<b>Selectfluor™ and Deoxfluor fluorinating reagents</b>
Fluorination	<ul style="list-style-type: none"> <li>Safe, mild, effective reagents</li> <li>Increased yields</li> </ul>
	<b>Hydrogen supply and optimization expertise</b>
Hydrogenation	<ul style="list-style-type: none"> <li>Reliable supply: largest producer of hydrogen, with multiple supply options</li> <li>Technical expertise in gas/liquid mass transfer and modeling and computational fluid dynamics to increase yields</li> </ul>
	<b>Nitrogen inerting</b>
Inerting and blanketing	<ul style="list-style-type: none"> <li>Safe storage and use of flammables or prevention of combustible dust explosions</li> <li>Improved quality and shelf life of air-sensitive materials</li> </ul>
	<b>Liquid nitrogen cooling</b>
Low-temperature reactions	<ul style="list-style-type: none"> <li>Safe processing of highly reactive chemistries such as butyllithium or Grignard reactions</li> <li>Easily combined with other refrigeration steps</li> </ul>
	<b>Liquid nitrogen prefreezing and refrigeration</b>
Lyophilization	<ul style="list-style-type: none"> <li>Prefreezing for increased viability and yield</li> <li>Improved performance and reliability and lower capital investment compared to mechanically cooled freeze-drying systems</li> <li>Reduced cycle times and improved solvent recovery</li> </ul>
	<b>PolarFit™ liquid nitrogen grinding or milling</b>
	<ul style="list-style-type: none"> <li>Freezing with liquid nitrogen followed by grinding</li> <li>Gaseous nitrogen for micronization applications</li> <li>Produces high-quality, very fine, uniformly sized particles</li> </ul>
Particle size reduction	<b>CRYO-CONDAP liquid nitrogen system for solvent condensation</b>
	<ul style="list-style-type: none"> <li>Condensing and recovery of solvents/VOCs using liquid nitrogen</li> <li>Compliance with the most rigid legislative requirements</li> </ul>
Solvent/VOC recovery	<b>Nitrogen sparging</b>
	<ul style="list-style-type: none"> <li>Strip out volatile contaminants, improve efficiency</li> <li>In-vessel and in-line systems</li> </ul>
Sparging/stripping	<b>Halia® oxygen aeration systems</b>
	<ul style="list-style-type: none"> <li>Increased capacity vs. air</li> <li>Improved productivity</li> <li>Can reduce VOC emissions by &gt;90%</li> </ul>

## Tap into our technology

Staying competitive often involves investing in new or better products, more efficient and safer work processes, or improved environmental compliance. Many pharmaceutical processes can be enhanced through gas technologies that help cut costs, improve quality, increase output, or improve safety. We can provide gas systems for applications ranging from aerobic fermentation to wastewater treatment.

In addition, because we manufacture specialty chemicals as well as medical and industrial grade gases, we understand the reaction chemistry, kinetics, mixing, and mass transfer issues that can be applied to your operations. Our engineers can assist you in evaluating your processes and identifying low-cost solutions to serve you and help optimize your productivity.



With our 24/7 logistics operation and TELALERT forecasting system, we maintain a 99.95% on-time delivery record that is second to none.

## Count on our dedication to safety and sustainability

At Air Products, nothing is more important than safety. It is a commitment we all share and one that we share with our customers. We are a safety leader in our industry and stand among the top performers of the CMA's Responsible Care program.

We put our safety expertise to work for you:

- Safety training in using our products safely
- Online Material Safety Data Sheets and Safetygrams
- 24/7 emergency response

Air Products has received numerous awards and recognition for its commitment to sustainability, including being named one of the 100 Best Corporate Citizens for 2012 by *Corporate Responsibility Magazine*.

Our history of innovation, applications expertise, and lasting customer relationships has given us insight to apply solutions to pressing energy and environmental needs. Our products, equipment, technology and experience have the potential to assist you in boosting energy efficiency, increasing throughput and capital efficiency of equipment, enhancing end product quality, and improving environmental performance.

Also, we have established new targets to further improve our own sustainability performance. For example, we have set goals to reduce energy consumption at our large air separation plants by 7% per quantity of gas produced and to reduce fuel and feedstock consumption per quantity of hydrogen produced at our hydrogen, carbon monoxide and synthesis gas facilities by 2015. Beyond energy, we are also reporting our water consumption and have committed to a 10% reduction by 2015.

## About Air Products

Air Products serves customers in many markets worldwide with a unique portfolio of products, services, and solutions. Founded in 1940, the company had fiscal 2011 revenues of \$10 billion, operations in over 40 countries, and 18,000 employees around the globe.



Air Products' compliance program for NF, EP, and USP grade gases covers every applicable regulatory standard for both production and transport.

## tell me more

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