

**Precision matters**  
in everything we do





Petrochemical refinery complex

**Our industry is highly complex.**  
But our vision is simple.

We provide precisely what you need, whenever and however it's needed.

Visit us at <http://hiq.linde-gas.com>

## Contents.

- 4 - 5 What we can do for you
- 6 - 7 Specialty gases products
- 8 - 9 How we measure
- 10 - 11 Business sectors
- 12 - 13 Setting standards
- 14 - 15 Specialty equipment products

**HiQ® specialty gases solutions.**  
Precision matters in everything we do.

HiQ® represents the best there is in the world of high purity gases, process and calibration gas mixtures, precision engineered gas supply solutions, and the high quality services needed for optimum results. Precise answers to individual needs. Customised to meet specific requirements. Delivered in a form and frequency tailored to each application. In a highly complex and specialised business sector, our vision is simple: we provide precisely what our customers need, whenever and however they need it.

The only word you need to remember in speciality gases is HiQ®.



HiQ® high precision filling

**Precision matters... in what we can do for you.** As part of a global business with more than a century of experience, Linde is a leading supplier of specialty gases and specialty equipment in every corner of the globe. We've achieved this position by being totally dedicated to meeting our customer's needs with maximum precision.

HiQ® specialty gases and mixtures for chemical composition analysis, clinical applications or quality-critical manufacturing are all supplied to the highest standards of purity and quality assured by ISO 9001 standard, as well as ISO 17025, and ISO Guide34 when required.

With Linde, you can trust a global leader to provide world-class products to the highest standards, across every business sector on time and to your specification.



ECOCYL™, Portable gas solutions



HiQ® gas mixture for Gas Chromatograph (GC) calibration



Infrared analysers used in Environmental monitoring

## Products

HiQ® offers an unmatched supply of specialty gases, and specialty equipment products to suit any application, plus many more that can be customised to match your requirements:

- ECOCYL™, Portable gas solutions are small refillable cylinders equipped with integrated regulator and flow meter. The all-in-one system enhances portability and convenience for remote calibration requirements
- Laserline® high purity gases and equipment for Laser applications
- Environmental gas products, certified to national, and international standards where required
- Automotive products, including exhaust emissions testing gas and other gases designed to test and improve engine efficiency
- VERISEQ® Gases have been developed to suit the needs of the pharmaceutical industry, helping manufacturers comply with the applicable regulations for gases used in pharmaceutical production
- Petrochemical gas products and equipment, with gas mixtures certified to national standards, where required, for traceability of results
- Food packaging products designed to maintain hygiene standards in food preservation businesses (gas products and suitable equipment)
- Pure gases, including Argon, Helium, Hydrogen and Nitrogen, ranging from process grades to higher than N6.0 purity
- BASELINE® and REDLINE® specialty gases equipment combine to ensure you have a choice of the right gas equipment for your application

## Business sectors

We supply customers across an extensive range of industries and markets:

- Petrochemicals, chemicals, pharmaceuticals and pulp & paper
- Automotive engine testing, manufacturing and servicing
- Engineering and construction
- Research and testing laboratories
- Water and power utilities
- Life sciences and medical
- Environmental and public health air quality monitoring
- Mining, mineral extraction and metal processing.

# Specialty Gases Products

**Precision matters... with every specialty gases product.** With HiQ®, Linde offers the widest range of high purity gases and selected gas mixtures, produced by our trained and experienced staff with a deep understanding of your expectations.

Our mixture product database contains over 25,000 individual product recipes all of which are maintained to ensure best filling and analytical procedures are followed. We can also create customised products to your specification.

## Pure gases

As a world leading gases and engineering company, Linde offers a complete line of pure and chemical gases to meet the everyday needs of companies around the globe.

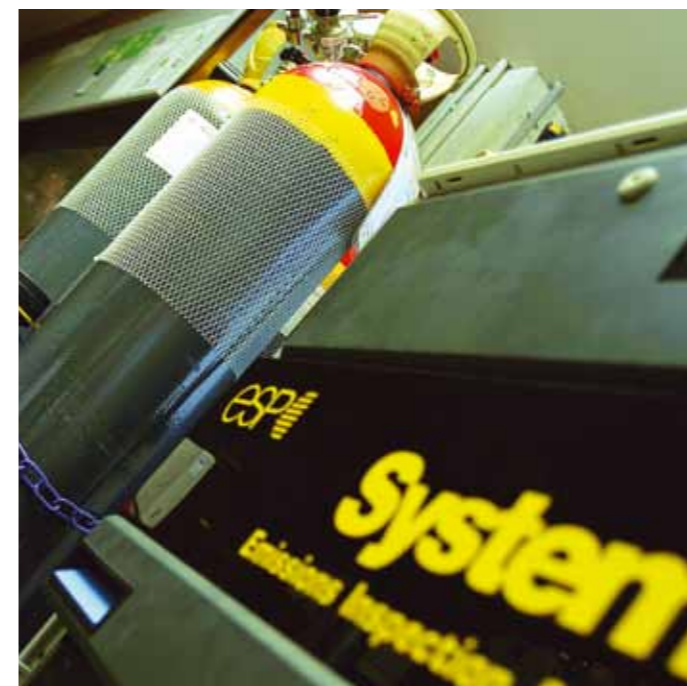
All pure gases are classified by grade, so you can be certain of purity levels. The first digit of the classification indicates the number of nines purity (for example, 3.0 = 99.9% purity). The second digit is the number following the last nine (for example 4.6 helium has a guaranteed minimum purity of 99.996% and a corresponding maximum impurity level of 0.004% or 40ppm).

- Rare gases, such as Neon, Krypton and Xenon are supplied in a variety of cylinder packages and amounts. Deuterium and other isotopic products can be sourced on request
- Hydrocarbon products including Ethane, Methane, natural gas, Propane and others are available in a variety of purity grades and package sizes to meet every requirement
- Chemical gases, such as Hydrogen Chloride, Hydrogen Sulphide, Ammonia, and Sulphur Dioxide can be supplied to meet requirements from small cylinder to large bulk containers or trailers.

## Gas mixtures

Gas mixtures are unique to industry requirements. Typical examples include multi-component hydrocarbon blends for use in the petrochemical industry, process or fuel gas mixtures, calibration gas mixtures for use in process laboratories, and certified mixtures for environmental monitoring.

Every mixture recipe is written by a Linde technical expert, who follows strict quality and safety guidelines to provide you with the proper gas product required for each particular purpose. We can utilise gravimetric or volumetric filling techniques, filling by weight or pressure respectively and have the ability to specify analysis results with tight analytical tolerances or uncertainty values based on your individual requirements.



Analysis and calibration cylinders



Taking a liquid sample for analysis

# How we measure

**Precision matters... in accuracies & tolerances.** With HiQ®, your specialty gases products are highly accurate, repeatable, stable, certified, and accredited. Using industry-leading measurement techniques, we provide gases with accuracies and tolerances to suit your needs. This leads to greater efficiency for you, enhancing your profitability.



Precision filling starts with cylinder preparation

## Taking accuracy to the next level

Our market leading production sites in the United Kingdom, Germany, Australia and Thailand manufacture calibration standards that set a new benchmark in accuracy. These facilities are accredited to ISO 17025 as a Calibration Laboratory and ISO Guide 34 as a Reference Material Producer. So when you order a calibration standard from Linde, you can be certain your product will benefit from:

- A high fill accuracy
- An accurately assessed and reported stability
- Certification to ISO standards
- Comprehensive data recording
- Rigorous processes to ensure repeatability.

## Certification methods

Linde follows gas industry best practice guidelines in using two main ways to assign a certificated value to a gas mixture. The first is by careful measurement of the weight of the gases being filled into the cylinder. The second is to analyse the contents by withdrawing product from the cylinder for post-fill analysis.

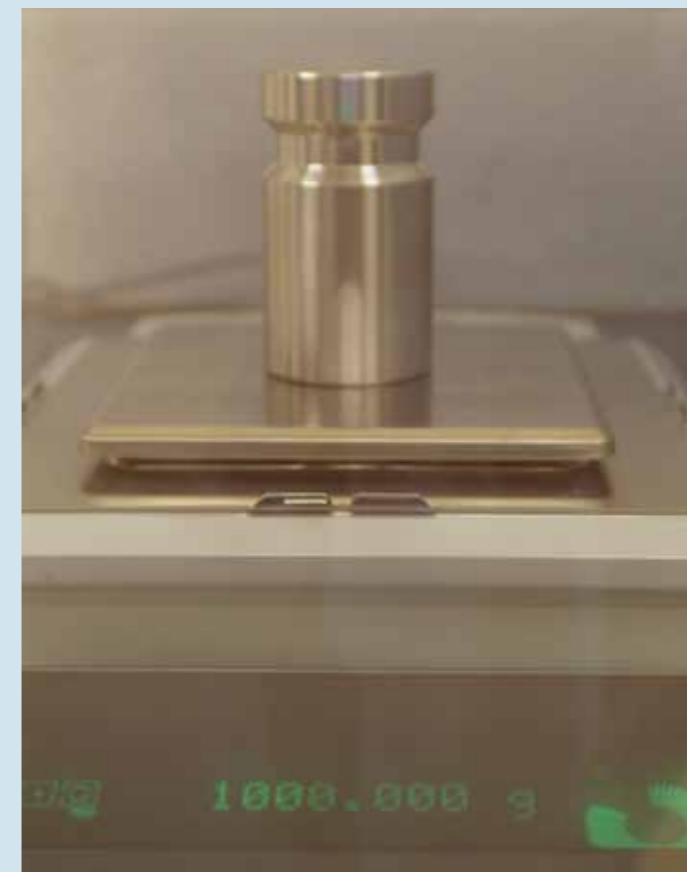
**Certification by weight:** Often called gravimetric certification, this can provide high filling tolerances and high certification accuracy. The modern mass comparators used by Linde have a resolution of 0.002g in 30000g. For this reason, mixtures filled this way can be said to offer an accuracy of +/-0.5%. With gravimetrically prepared mixtures, this filling tolerance is often quoted as the certification accuracy.

**Certification by analysis:** This involves analysing the gas from a cylinder and comparing the result of that analysis to a known gas standard on the same instrument. The degree of accuracy of the analysis determines the quality of the product sold.

## Analytical & fill tolerance

This brief explanation of terms used by Linde and our customers may be helpful to you:

- Accuracy is the degree of conformity of a measured or calculated value from its actual or specified value.
- Tolerance is the permissible range of variation of some characteristic from its nominal value. It is governed by what is practically achievable within the constraints imposed by people and machines.
- Measurement uncertainty is the property of the result of a measurement that characterises the spread of the values that could reasonably be attributed to the result (the sum of all errors inherent within the measurement process).
- Gas mixture certificate results: Linde generally quotes relative accuracy on a certified result, meaning the proportion of the error to the whole. The alternative is to quote absolute accuracy where the quantity of the error is quoted. If absolute accuracy is used this will be clearly stated.



Gravimetric traceable weight reading

**Linde** ISO Guide 34: Reference Material Standard

Reference Material Producer / Hersteller von Referenzmaterialien  
 accredited by / akkreditiert durch  
**Deutsches Akkreditierungssystem Prüfwesen GmbH**

DAK-PL-4417.00

Comment: The laboratory DAP-PL-4417.00 is accredited on basis of ISO Guide 34:2000 and DIN EN ISO/IEC 17025:2005  
 Hinweis: Das Labor DAP-PL-4417.00 ist akkreditiert nach ISO Guide 34:2000 und DIN EN ISO/IEC 17025:2005

CRM-Certificate No. CRM-Zertifikat-Nr.	Linde-CRM-0718	Title Titel	LCRM-02
Cylinder number Zylinderkennnummer	20015510	Order No. Auftragsnummer	10300001987
Date of production Herstellungstermin	27.11.2008		
Manufacturer Hersteller	Linde AG, Spezialgase Deutschland, Carl-von-Linde Str. 25, D-85716 Unterschleißheim, GERMANY, CRM@de.Linde-Gas.com		
Customer Auftraggeber	Mustermann Corp., Musterstrasse 48, DK-88765 Mustercity		
Product / Conditions Herstellungstermin / Bedingungen	Primary Gravimetric Calibration Gas Mixture / ISO 6142:2006		

Certified Amount Fractions and Uncertainty / Zertifizierte Werte und Messunsicherheit			
Species Beimengung	Amount Fraction Stoffmengenanteil (10 <sup>3</sup> mol / mol)	Species Beimengung	Amount Fraction Stoffmengenanteil (10 <sup>3</sup> mol / mol)
Nitrogen Stickstoff	4.989 ± 0.025	iso-Pentane iso-Pentan	0.4924 ± 0.005
Carbon Dioxide Kohlendioxid	1.0125 ± 0.0050	Methane Methan	0.48 ± 0.00
Ethane Ethan	2.505 ± 0.012		
Ethane Ethan	0.4924 ± 0.005		
Propane Propan	0.9905 ± 0.009		
Propane Propan	0.4870 ± 0.0040		
iso-Butane iso-Butan	0.1991 ± 0.0013		
n-Butane n-Butan	0.1964 ± 0.0013		

Cylinder volume / Behälter-Volumen 10 Liter  
 Filling pressure / Fülldruck 50 bar  
 Value added / wert: DIN 477, No 14  
 Date of expiry / Verwendbar bis 27.11.2011

Min. storage temperature / Min. Lagertemperatur 0 °C  
 Min. pressure of utilization / Min. Verwendungsdruck 3 bar  
 Handling / Handhabung Refer to ISO 10064:2004  
 Intended use / Verwendung Calibration Standard

The components were certified on the basis of gravimetry in accordance with ISO 6142:2006. The results were verified against primary and/or internationally traceable reference material. The expanded uncertainty assigned to the measurement results is obtained by multiplying the standard uncertainty by the coverage factor k = 2. It has been determined in accordance with "Guide to the expression of uncertainty in measurement". The value of the measurement lies within the assigned range of values with a probability of 95%.

Die zertifizierten Werte wurden auf Basis der Gravimetrie in Übereinstimmung mit ISO 6142:2006 ermittelt. Die Ergebnisse wurden gegen primäre und/oder international nachweisbare Referenzmaterialien verifiziert. Die den Messergebnissen zugeordnete erweiterte Messunsicherheit ergibt sich aus der Standardunsicherheit durch Multiplikation mit dem Erweiterungsfaktor k = 2. Sie wurde gemäß "Guide to the expression of uncertainty in measurement" ermittelt. Der Wert der Messgröße liegt mit einer Wahrscheinlichkeit von 95% im zugewiesenen Wertebereich.

Sea Stempel	Date Datum	Head of Laboratory Laborleiter	Person in charge Beauftragter
	21.11.2008	Page Adam	Stephan Wollner

1 of 1 page

# Business sectors

**Precision matters... across industries & markets.** Linde works with many leading corporations, manufacturers, research organisations, government agencies and small niche specialists, providing outstanding gas products for the widest range of applications.



Car exhaust emissions

## Automotive

Linde provides a variety of products for automotive manufacturing, engine testing, and servicing. These include gas mixtures to test engine efficiency in product development, calibration mixtures to verify exhaust emission standards are met, Laser cutting gases and Xenon for use in the manufacturing of head lamps.

## Petrochemicals

Linde supplies a variety of high purity specialty gases and complex multi-component gas or liquid mixtures to our petrochemical customers. The oil and gas processing industry is at the forefront of developing ever more accurate measurement techniques. Linde recognises this and has world-leading, purpose-built facilities in strategic areas around the globe producing hydrocarbon calibration standards for the ultimate in measurement accuracy.



Stack emissions



Anaerobic culture growth



Research and testing

## Environmental Monitoring

International accords call on industry everywhere to monitor, control and reduce their emissions before discharging them into the environment. The HiQ Environmental product portfolio, which includes our SPECTRA-SEAL® calibration standards and SPECTRA® VOC or Mercury standards are used for Smoke Stack Emission and Continuous Emission Monitors to verify daily emission levels conformance to legislative requirements, as well as potential participation in emission trading schemes.

## Pharmaceutical and Biotech Industry

With pharmaceutical and biotech production, suppliers must perform to stringent standards of product quality and control. In addition to HiQ® specialty gases, Linde has a complete line of VERISEQ® traceable pharmaceutical gases that are used in many areas, from an ingredient in the manufacture of APIs, Research & Development, and Quality Control.

## Research

Research and testing laboratories require a vast library of standard and bespoke gas products, both pure gases and gas mixtures. Linde has the experience and ability to meet these requirements. Our extensive database containing over 25,000 individual recipe records, with new products created every week.

## Law enforcement

LINDE holds accreditation to ISO 17025 for the production and certification of evidential breath mixtures. Interference gas mixtures are also produced to ensure accurate calibration of the breathalyser instrument.

## Other industries

Linde produces and stocks a wide variety of pure gases and gas mixtures used across a variety of market sectors. These include lighting mixtures, automotive test gases, food packaging mixtures, laser mixtures (premix and pure gas), welding mixtures, refrigeration and sterilisation gases.

# Setting standards

**Precision matters... in setting standards.** With HiQ® specialty gases we are committed to the excellence of our products and services, underlined by our accreditation to international standards on quality, safety and environmental management. With HiQ® you can expect consistent and robust procedures in the production of every pure gas and calibration gas mixture. All aspects of gas monitoring and analysis are covered, from contract review through preparation, analysis and certification.

## ISO 9000 for end-to-end quality

The cornerstone of our commitment to quality is a quality management system meeting the requirements of the ISO 9000 series of standards. Recognised around the world, ISO 9000 describes the elements essential to creating a comprehensive quality system – from design, procurement, manufacture, testing and delivery, to maintenance by audits, corrective action and management review.

## ISO 9001 to meet your expectations

Linde is also ISO 9001:2000 certified, demonstrating that our quality control procedures are regularly subjected to independent scrutiny and that we are committed to continuous improvement, based on the evolving needs of our customers and their feedback. Linde has had more than 250 facilities worldwide certified since 1988.



Xenon lighting for theatre surgery

## ISO 17025 for competence in testing and calibration

ISO 17025:2005 specifies the general requirements for the competence to carry out tests and/or calibration, including sampling. It covers testing and calibration performed using standard methods, non-standard methods, and laboratory-developed methods and is applicable to all organizations performing tests and/or calibration.

Many Linde specialty gas facilities around the globe are certified to ISO 17025:2005 as testing and/or calibrating laboratories to ensure the purity, specification and shelf life of our HiQ® products are precisely what you requested, with the stability of our gas mixtures guaranteed.

## ISO Guide 34:2000 for reference material production

HiQ® specialty gas facilities in the United Kingdom, Germany, Australia and Thailand have also received accreditation to ISO Guide 34. ISO Guide 34 provides the highest level of quality assurance, and allows Linde to confidently state that the methods used to certify our certified reference standards are accurate, consistent, documented and validated.

ISO Guide 34 defines reference materials as substances with a precise composition traceable to the International System of Units (SI) using accurate measurements



## Specialty Equipment Products

**Precision matters... in our gas equipment.** When using specialty gases for analysis and high-tech production, it's essential to maintain the integrity of the gas between cylinder and instrument or reactor. The quality of your gas supply is only as good as the quality of your gas distribution system. Therefore, it is very important to design and plan the gas supply system carefully.



S201 Gas Supply Panel



HiQ Zero Air Generator

Linde can help. We offer an unrivalled range of gas control equipment, including cylinder mounted gas regulators, gas control panels and point of use units.

### Exceptional quality for you

- REDLINE® gas supply panels, cylinder regulators, and point of use are designed to meet purity requirement that exceed 99.9999%. Used with either single cylinders or multi-packs, REDLINE® is designed to ensure purity is maintained from start to finish.
- REDLINE® toxic and chemical gas supply panels are designed with welded fittings and face seal connections. These fittings are becoming more and more popular with ultra high purity gas handling systems to prevent potential leaks.
- HiQ® Storage Cabinets ensure gas cylinder safety. Choose from indoor single cylinder type to a full size outdoor storage container complete with ready-to-use gas supply systems to ensure a protected environment for gas cylinder storage and handling.
- BASELINE® gas supply products are our entry level for the world of specialty gas equipment. Designed for gas purities up to 99.999%, BASELINE® offers a stable operation industrial regulators cannot offer.
- HiQ® Gas Generators – for customers where storage or the use of gas cylinders may be unsuitable. Small and reliable, these generators provide gas on-site for instant use and will shut off the gas supply automatically if there's a power failure. Variable flow rates are available, dependant on the gas purity required.

### Engineering Expertise

As part of the Linde group, we have experience in bringing large and small-scale engineering projects to market. In addition to our gas supply panels and installations, we also can offer external ready-to-use gas storage and supply systems (containers) to complete any system.



# Getting ahead through innovation.

With its innovative concepts, Linde is playing a pioneering role in the global market. As a technology leader, it is our task to constantly raise the bar. Traditionally driven by entrepreneurship, we are working steadily on new high-quality products and innovative processes.

Linde offers more. We create added value, clearly discernible competitive advantages, and greater profitability. Each concept is tailored specifically to meet our customers' requirements – offering standardised as well as customised solutions. This applies to all companies regardless of their size.

If you want to keep pace with tomorrow's competition, you need a partner by your side for whom top quality, process optimisation, and enhanced productivity are part of daily business. However we define partnership not merely as being there for you but being with you. After all, joint activities form the core of commercial success.

Linde – Ideas become solutions.