

Innovative Analytical & Pharmaceutical Solutions.



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

Precision matters... we provide precisely what you need, whenever you need it. As part of a global business with more than 100 years of experience, BOC is the South Pacific's leading supplier of speciality gases and equipment.



Contents.

| Industries. | 12 |
|---|----|
| Specialty gas products. | 14 |
| Specialty gas mixtures. | 16 |
| Setting standards. | 22 |
| HiQ [®] specialty gas equipment. | 24 |



BOC supplies the South Pacific's most comprehensive range of industrial, medical and special gases, associated products and services.

About BOC.

BOC is A Member of The Linde Group which supplies compressed and bulk gases, chemicals and equipment around the globe.

The company develops safe, sustainable and innovative solutions for customers in many specialty sectors, heavy industry and medical environments.

For more than a century the company's gases and expertise have contributed to advances in industry and everyday life, including steelmaking, refining, chemical processing, environmental protection, wastewater treatment, welding and cutting, food processing and distribution, glass production, electronics and health care.

About The Linde Group.

The Linde Group is a world-leading gases and engineering company with around 65,000 employees working in more than 100 countries worldwide.

The strategy of The Linde Group is geared towards longterm profitable growth and focuses on the expansion of its international business with forward-looking products and services. Linde acts responsibly towards its shareholders, business partners, customers, employees, society and the environment in every one of its business areas, regions and locations across the globe.

Linde is committed to technologies and products that unite the goals of customer value and sustainable development. For further information, refer to www.linde.com

Our company values.

- → Passion to excel
- → Innovating for customers
- → Empowering people
- → Thriving through diversity

Our vision.

We will be the leading global gases and engineering company, admired for our people, who provide innovative solutions that make a difference to the world.

Supply solutions tailored for you.

BOC can supply the world's leading vacuum and cryogenic systems to offer you a comprehensive range of durable, high quality dewars, cryogenic freezers and liquid cylinders and vessels.

BOC fills more than 40,000 cylinders each day from 12 industrial and medical filling sites in the South Pacific, and provides cylinder gas to more than 350,000 delivery points.

Cylinders are the ideal means of supply for smaller volumes of gas, offering flexibility of demand.

Electronic tracking.

Each of BOC's cylinders has a unique barcode. These barcodes are recorded at each key transaction, to and from your site. This is further supported by scanning of each cylinder at maintenance, filling and distribution. Recorded barcode information means that BOC can easily locate and identify each cylinder, providing a greater level of transparency for BOC and you.

The benefits of cylinder tracking are:

- \rightarrow Cylinder holdings are accurate down to the last cylinder
- → Invoice accuracy
- → Reduced administration time
- \rightarrow Easy access to assistance and information

Cylinder Maintenance Centre.

BOC has invested \$14.8M to develop an innovative Cylinder Maintenance Centre (CMC). The CMC is a state of the art test shop where robotics are used to pick up, move and inspect each cylinder. In this facility, cylinders are ultra-sonically tested for safety, powder coated and electronically barcoded into a system which stores the history of that cylinder. The Cylinder Maintenance Centre allows BOC to deliver safer and better quality cylinders to you.

CRYOSPEED[®].

BOC's CRYOSPEED[®] solution offers ideal solutions where larger gas volumes of up to 400m³ per week are required. CRYOSPEED[®] can meet your needs by providing a hands free delivery of liquid argon, carbon dioxide, nitrogen or oxygen. Cryotanks are used for the storage of cryogenic liquids and for the dispensing of their contents in either liquid or gaseous forms. Their design allows for simple, compact, low cost installations.



CRYOFILL[®] - Cryogenic Helium.

Given the importance of maximising MRI system uptime, you need a supplier who can guarantee the Helium supply required for operation of your MRI/NMR system(s). We are a proven partner with years of experience serving MRI/ NMR system manufacturers, third party service providers and individual hospitals/clinics. We operate the only Helium liquefaction facility in Australia meaning BOC has a secure supply of Helium despite this volatile global market. Our delivery options include assisted MRI magnet fills to allow you to focus on your research activities.

Bulk Liquid.

Ideal for customers who use more the 2,500m³ per week, BOC's analytical bulk offer means we will deliver the liquid nitrogen, carbon dioxide, argon or oxygen you need to keep your research moving. These products are stored in bulk vessels on your site. BOC monitors your usage via telemetry and delivers product when you need it without the need for you to place an order. These cryogenic liquids may be dispensed in either liquid or gaseous forms depending on your requirements.

Making it easier for you to do business.

BOC is committed to make it easier for you to focus on your core business.

Extensive distribution network.

With an BOC's extensive distribution and retail network across Australia and New Zealand.

BOC customers have access to:

- → More than 80 Gas & Gear retail centres in Australia and New Zealand
- → Over 800 Equipment Partners and Gas Agents in Australia and 65 Distributor Partners in New Zealand
- → We also have a significant logistics infrastructure to support our gas deliveries around Australia and New Zealand

We will identify your critical needs and ensure a stock model is accommodated at each of our local Gas & Gear operations to cater to your demand.

Customer service and support.

BOC's Customer Engagement Centre is ready to respond to a wide range of customer needs from 24/7 emergency response through to routine enquiries and taking orders, all via a range of communication channels.

BOC understands that delivery service levels and Delivery in Full, On Time (DIFOT) is critical, as is an emergency supply of gas in times of need. In addition to measuring performance, any deferrals are analysed to identify the root cause so that preventative measures can be put in place.

To ensure you get the best customer service our Customer Engagement Centre, Specialty Markets, is diligent in ensuring minimal wait times are experienced by our customers. Some measures include:

- \rightarrow More than 80% of calls to be answered within 20 seconds
- → Quality Assurance for call quality & staff coaching

Flexibility in order taking.

You can place orders in a variety of ways including:

- → Online via boc.com.au and boc.co.nz
- → Scan to Oder BOC mobile app
- → Electronic Data Interchange (EDI) systems
- → Email
- → Phone
- → Fax
- → Via your local Gas & Gear

Invoicing options.

BOC offers a full suite of invoicing options.

Transactional invoicing.

A standard invoice is produced for every sales transaction. This is ideal for where you wish to distinguish different product groups, by separate invoices.

Product invoice list.

Multi delivery invoice groups together all transactions in a month by location and gives a summary total. All product transactions are listed on one invoice, issued at the end of the month.

This type of invoicing is not recommended for customers that require departmental sign off on invoices.

Combined invoice list.

This is a multi delivery invoice – similar to Product Invoice List, as it groups together all transactions made within a month by location and gives a summary total. All product transactions are on one invoice issued at the end of the month.

Both Product Invoice List and Combined Invoice List dramatically reduce the number of invoices sent in a calendar month, reducing your processing time and internal administration costs.

We also have the capability to offer electronic invoicing and trading and would be happy to work with your IT department to scope the project specification.



Services to support you.

Customer Engineering Services.

Customer Engineering Services (CES) is BOC's equipment installation and maintenance department responsible for over 4,000 industrial and medical gas supply schemes including compressed gas cylinders, bulk vessels, smaller cryogenic vessels, on-site gas generation equipment and associated pipe work. The CES applications team manages the development of end use process equipment for the food, water and combustion industries.

The department manages around 400 major projects every year throughout the South Pacific.

CES also offers a complete HiQ[®] maintenance package to support compliance for your own analytical, industrial and medical gas equipment.

HiQ[®] Gas Facilities Management Services.

At BOC our vision for the HiQ[®] Gas Facilities Management Service is to deliver continuous quality improvement and productivity gains for your laboratory. BOC aims to provide significant savings by reducing cylinder holdings and rental costs, while minimising your effort for gas management. Additional services by trained BOC personnel include regulator assessments on your site, cryogenic and gas safety training and movement of cylinders around your site direct to the end user.

Cryocare.

The ongoing maintenance of portable cryogenic containers requires specialised training and equipment. BOC has the experience required to help you maintain your cryogenic containers supplying you with a loan container while your critical equipment is undergoing its maintenance with our trained engineering team.



100% safety, 100% of the time.

Safety is BOC's top priority.

We are passionate in our belief that safety should not be left to chance.

BOC is fully compliant with Occupational Health and Safety Regulations 2001 – Chapter 5, Clause 128 "Maintenance, repair, testing and cleaning of plant-particular risk control measures.

BOC is also your one stop shop for your cryogenic safety requirements. We have a comprehensive range of safety gloves, safety glasses (including prescription glasses), safety goggles, face shields and aprons.

Helping our customers with gas safety.

We share our safety knowledge and expertise with customers in a number of ways:

- → Improving cylinder valves, cylinder safety and cylinder handling via design enhancements
- ightarrow Training on safe handling of cryogenic liquids and cylinders

- → Ensuring a safe environment when delivering cylinders or bulk gas e.g. addressing access issues
- ightarrow Thorough inspection of cylinders including ultrasonic testing
- → Regular revision of internal standards to improve the management and logistics of gases
- → Increase awareness for customers with literature such as the BOC YouTube Channel, Guidelines for Cylinder Gas Safety, Safe Transportation of Gases, and Top 10 Cylinder Tips
- → Customised truck fleet to support cylinder despatch, backed by comprehensive driver safety training.

Safety Data Sheets for every gas outlining the composition and an explanation of the emergency response procedure. All BOC SDS are available online at www.boc.com.au, www. boc.co.nz or by contacting our Customer Engagement Centre on 1800 658 278 (Australia) or 0800 100 949 (New Zealand) or scientific@boc.com (Australia) or scientificnz@boc.com (New Zealand).



Helping you educate your staff.

BOC is proud to be the technical leaders in gas for the Analytical market. We understand the importance of sharing this knowledge with you and have developed a few easy avenues:

You Tube

BOC has an extensive library of YouTube videos, which cover a wide range of topics from gas safety, use, tips and tricks of the trade.



Designed for the analytical and research sectors precisionmatters.com.au is an allencompassing educational and informational resource that is available for you and your staff



Our online shops at boc.com.au and boc.co.nz contains all the product specific information you need.



Your friendly Analytical Specialist is always able to help you with your enquiries. Similarly, our experienced Customer Engagement Team is on hand to help you on 1800 658 278 (Australia) or 0800 100 949 (New Zealand) or scientific@boc.com (Australia) or scientificnz@ boc.com (New Zealand)

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

Aimed at meeting the needs of the analytical and research sector, HiQ[®] represents the best BOC has to offer:

- \rightarrow High purity gases
- → High accuracy gas mixtures
- \rightarrow Disposable cylinder for bump testingHigh quality BASELINE[®] gas regulators
- \rightarrow Precision engineered REDLINE[®] gas supply systems

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



Industries.

Precision matters... across industries and markets. BOC works with many leading corporations, manufacturers, research organisations, analytical laboratories, government agencies and niche specialists, providing outstanding gas products and services for the widest range of applications.





Stack emissions monitoring.



Anaerobic culture growth.



Pharmaceutical manufacture.

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

Automotive.

BOC provides products for automotive engine testing, manufacturing and servicing. We supply gas mixtures designed to test engine efficiency for product development as well as calibration gases to ensure that legal standards on exhaust emissions are met. Highly durable, high purity HiQ[®] equipment is also essential for the reliable supply of these calibration standards.

Environmental.

BOC's products and services sit at the forefront of environmental management. From water, soil and air quality monitoring to solar panel manufacturing, we provide the expertise to help you to tackle your environmental challenges. Through ongoing development we will continue to provide innovative products and solutions to help you meet legislative and regulatory demands, minimise operational costs and assist you in fulfilling your corporate responsibilities.

Healthcare.

BOC has longstanding partnerships within the Healthcare industry, including medical laboratories, IVF clinics and a range of research facilities. We supply bespoke gas mixtures to Healthcare facilities for their chosen application. BOC prides itself on producing gas mixtures with components in the precise proportions requested by the organisation.

Pharmaceutical and biotechnology.

Gases are employed in the manufacture of active pharmaceutical ingredients (APIs) and pharmaceuticals, in R&D as well as production and quality control. Pharmaceutical laboratories use analytical instruments such as gas chromatographs with multiple detectors, high performance liquid chromatographs (HPLC), UV/VIS spectrometers, and NMR spectrometers. These instruments require gases or calibration standards with known degrees of accuracy, purity and composition. BOC meets these requirements through its HiQ[®] special gases range.

Mining.

HiQ[®] specialty gases play important roles in mining and metallurgy. During mining operations, a variety of calibration standards are used to calibrate gas sensors for oxygen deficiency, as well as other specific compound measurements based on mine operations to ensure employee safety.

Petrochemicals.

BOC supplies high purity pure gases and complex multi-component gas or liquid mixtures to our customers for calorific calibration or composition analysis. The oil and gas processing industry is at the forefront of developing ever more accurate measurement techniques and BOC ensures these methods are achievable through the use of HiQ[®] calibration mixtures.

Specialty gas products.

Precision matters... in every gas product. With access to an established global network and superior local production and distribution capabilities, BOC has the ability to provide a wide range of high purity products. We make it our priority to ensure that you have the gas solution your process requires.



BOC's meticulous approach to producing ultra-high purity gases provides you with the assurance you need to conduct your analytical work with confidence.

Our strict quality control procedures minimise the possibility of impurities such as hydrocarbons, moisture, oxygen or carbon dioxide undermining the accuracy of your work.

Even at very low levels, these contaminants can have a detrimental impact on the results and maintenance requirements of your analytical instrumentation.

High purity gases.

Pure gases are classified by grade, so that you can be certain of purity levels. The first digit of the classification indicates the number of nines purity and 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 40 ppm).

Nitrogen, Oxygen, Argon, Hydrogen, Helium and Carbon Dioxide are available in a variety of grades from 4.0 to 5.0 in cylinder packages to suit your application.

Other gases.

Rare gases (Neon, Krypton and Xenon), research hydrocarbon products (including Ethane, Methane, Propane), other isotopic compounds (e.g. Deuterium), Carbon Monoxide, Ammonia, Silane and many others can be sourced through our international supply chain.

Pure gas applications.

BOC offers a wide range of analytical application gases required for carrier, purge, detector and other applications. BOC's pure gases have a broad range of applications including:

| Instrumentation | Major Concern | Use* | Minimum purity requirement | NZ Gas Code | AU Gas Code |
|---|---|------|----------------------------|----------------|----------------|
| | | | | | |
| CHROMATOGRAPHY | | | | | |
| Flame Ionization Detector (FID) | Total hydrocarbons, Moisture, | C/M | Helium 5.0 | 220 | 220 |
| | Oxygen | C/M | Nitrogen 5.0 | 234 | 234 |
| | | C/D | Hydrogen 5.0 | 240 | 240 |
| | | D | Synthetic Air | 801 | 055 |
| | | D | 40% Hydrogen in Helium | 146 | 146 |
| | | D | 40% Hydrogen in Nitrogen | On applic | cation |
| Thermal Conductivity Detector (TCD) | Moisture, Oxygen | C/M | Helium 5.0 | 220 | 220 |
| | | C/M | Hydrogen 5.0 | 240 | 240 |
| | | C/M | Nitrogen 5.0 | 234 | 234 |
| | | С | Argon 5.0 | 021 | 262 |
| Electron Capture Detector (ECD) | Total hydrocarbons, Moisture, | С | Helium 5.5 | On applic | cation |
| | Oxygen, Halocarbons | С | Hydrogen 5.0 | 240 | 240 |
| | | C/M | Nitrogen 5.0 | 234 | 234 |
| | | C/M | 5% Methane in Argon | On applic | cation |
| | | C/M | 10% Methane in Argon | On applic | cation |
| Flame Photometric Detector (FPD) | Sulfur or phosphorous | С | Argon 5.0 | 021 | 262 |
| | components (Hydrogen sulfide, Sulfur dioxide, Sulfides), Carbon Dioxide | С | Helium 5.0 | 220 | 220 |
| | | C/M | Nitrogen 5.0 | 234 | 234 |
| | | C/D | Hydrogen 5.0 | 240 | 240 |
| | | D | Synthetic Air | 801 | 055 |
| Nitrogen Phosphorus Detector (NPD) | Ammonia, Amines | C/M | Helium 5.0 | 220 | 220 |
| | | C/M | Nitrogen 5.0 | 234 | 234 |
| | | D | Hydrogen 5.0 | 240 | 240 |
| | | D | Synthetic Air | 801 | 055 |
| Photo Ionization Detector (PID) | Total hydrocarbons, Carbon | С | Helium 5.0 | 220 | 220 |
| | Dioxide | С | Nitrogen 5.0 | 234 | 234 |
| SPECTROMETRY | | | | | |
| Gas Chromatography Mass Spectrometry | Total hydrocarbons, Moisture, | С | Helium 5.0 | 220 | 220 |
| (GC-MS) | Oxygen, Carbon Dioxide | С | Hydrogen 5.0 | 240 | 240 |
| | | С | Nitrogen 5.0 | 234 | 234 |
| Fourier Transform Infrared Spectroscopy | Moisture, Total hydrocarbons, | Р | Nitrogen 5.0 | 234 | 234 |
| (FTIR) | Carbon Dioxide | Р | Argon 5.0 | 021 | 262 |
| Atomic Absorption Spectrometry (AAS) | Moisture, Hydrogen sulfide, | D | Synthetic Air | 801 | 055 |
| | Phosphine | D | Nitrous Oxide 2.5 AAS | 621 | 621 |
| | | D | Acetylene 2.6 AAS | On applic | cation |
| Inductively Coupled Plasma Spectrophotome | ter (ICP) | D | Argon 5.0 | 021 | 262 |

*C = Carrier M = Make-up (balance)

P = Purge

D = Detector

Specialty gas mixtures.

Precision matters... in specialty gas mixtures. Our database of gas mixtures contains over 5,000 individual product recipes, all designed to ensure that the final product is fit for purpose. We can also create customised blends to meet your individual requirements.



Gas mixtures are unique to application and industry requirements. In order to meet your requirements a wide range of HiQ[®] mixtures are available, ranging from simple two component mixtures to highly complex mixtures containing more than twenty components with concentrations ranging from parts per million to percent levels.

HiQ[®] gas mixtures are formulated by BOC's experienced technical team supported by the latest thermodynamic software to ensure safety, accuracy and stability. This is your assurance that the gas mixture is fit for your particular purpose. BOC utilises a range of gravimetric, volumetric and manometric filling techniques enabling us to achieve the appropriate preparation tolerance and certification accuracy.

BOC offers a variety of mixture types to suit all applications:

Calibration Standards.

→ HiQ[®] ENVIRONMENTAL STANDARD: For applications requiring traceability to national metrology institute reference standards.

- → HiQ[®] PRIMARY GRAVIMETRIC STANDARD: For applications requiring highly accurate standards which are traceable to the Australian or New Zealand national standard of mass.
- → HiQ[®] CERTIFIED CALIBRATION STANDARD: For routine calibration where the high accuracy of HiQ[®] PRIMARY GRAVIMETRIC STANDARD is not required. Traceable to HiQ[®] PRIMARY GRAVIMETRIC STANDARDS or international gas standards sourced from national metrology institutes.

Process Application Mixtures.

- → HiQ[®] DIVING MIXTURE: Specifically formulated to ensure compliance with the requirements of the international commercial diving industry.
- → HiQ[®] SPECIAL APPLICATION MIXTURE: Specialised mixtures for process specific applications where the high accuracy of HiQ[®] PRIMARY GRAVIMETRIC STANDARD and the traceability of HiQ[®] CERTIFIED CALIBRATION STANDARD is not required.



Calibration standards for environmental monitoring.

HiQ[®] ENVIRONMENTAL STANDARDS.

Environmental issues have a great impact on our daily lives and it is well known that various pollutants are harmful to the environment. There are both global agreements, such as the Kyoto Protocol, and local regulations aimed at limiting emissions. Consequently, industries are under increasing pressure to monitor and reduce harmful emissions. To meet the growing demand for mixtures with proven traceability BOC has included ENVIRONMENTAL STANDARDS in the HiQ[®] calibration gas range.

EPA protocol.

HiQ[®] ENVIRONMENTAL STANDARDS produced by BOC comply with (EPA-600/R-12-531) G1 and G2 procedures for the Assay and Certification of Gaseous Calibration Standards.

The following components and concentrations are covered by EPA-600/R-12-531 G1/G2 and a selection of the HiQ[®] ENVIRONMENTAL STANDARDS are available from BOC.

| Component | Concentration | Balance |
|-------------------------------|---------------|---|
| | | |
| CO ₂ | 10 ppm – 20% | Air or Nitrogen |
| CO | 1 ppm – 15% | Air or Nitrogen |
| CH ₄ | 1-1000 ppm | Air or Nitrogen |
| NO | 0.5 ppm – 1% | Nitrogen |
| NO ₂ | 5–200 ppm | Air or Nitrogen (min 1% O ₂) |
| 02 | 1-25% | Nitrogen |
| C ₃ H ₈ | 1 ppm – 2% | Nitrogen |
| SO ₂ | 1 ppm – 1% | Air or Nitrogen |

Quality control.

HiQ[®] ENVIRONMENTAL STANDARDS are prepared using a variety of techniques and, where appropriate, standards are evaluated for stability using repeat analysis and statistical techniques.

All HiQ[®] ENVIRONMENTAL STANDARDS are supplied to the highest standards of purity and quality, assured by compliance with ISO Guide 34:2009.

Reference Standards are used by BOC to certify ENVIRONMENTAL STANDARDS meet strict traceability requirements. They are sourced from a recognised national metrology institute, which must be a signatory to the BIPM mutual recognition agreement.*

Technical Specifications

| Concentration | Preparation Tolerance | Certification Uncertainty^ |
|------------------------------------|---------------------------|-------------------------------|
| HiQ [®] ENVIRONMENTAL STA | NDARD (ENV) | |
| > 0.1-1% | ±5% relative | < 2% |
| >100ppm-0.1% | ±5% relative | < 2% |
| > 5–100 ppm | ±5% relative | < 2% |
| ≤5ppm | Typically 10% relative | < 2 % |

*This is an arrangement between national metrology institutes which specifies terms for the mutual recognition of national measurement standards and for recognition of the validity of calibration and measurement certificates issued by national metrology institutes. It is drawn up by the CIPM with the authority given it under Article 10 (1921) of the Rules Annexed to the Metre Convention. NIST (USA), VSL (Netherlands), NMi (Australia) and NPL (UK) are all signatories to the agreement.

^A total actual uncertainty not exceeding 2% of the concentration is reported on the certificate. Assay uncertainty must not exceed 1% relative.

Calibration standards for quantifiable success.

Calibration standards comprise the largest and most diversified group of special gas mixtures from BOC. Such standards are used to calibrate analytical equipment used in pure research, production laboratories and process monitoring.

HIQ[®] PRIMARY GRAVIMETRIC STANDARDS.

These are produced by weighing high purity, analysed raw materials into a cylinder or container using high capacity, high accuracy balances. These balances are regularly calibrated by approved calibration laboratories ensuring that HiQ[®] PRIMARY GRAVIMETRIC STANDARDs are traceable to the national standard of mass.

The composition of the mixture is calculated from the component masses and known raw material purity. The resulting mixture accuracy is very high and is in compliance with *ISO 6142 Gas analysis*. *Preparation of calibration gas mixtures*. *Gravimetric method*.

The accuracy achievable with the gravimetric method significantly depends on the purity and molecular weight of the parent gas used to produce the mixtures. Therefore BOC only uses high-purity base gases and cylinders, which have undergone first-class pre treatment.

HiQ[®] CERTIFIED CALIBRATION STANDARDS.

These can be prepared using weight, pressure or volumetric techniques. BOC technical staff determine the most appropriate method based on the properties and composition of the mixture. HiQ[®] CERTIFIED CALIBRATION STANDARDs are compared against reference standards using a wide range of validated methods, ensuring traceability to HiQ[®] PRIMARY GRAVIMETRIC STANDARDs or international gas standards sourced from National Metrology Institutes. The manufacture



Gravimetric traceable weight reading.

is in compliance with *ISO 6144 Preparation of calibration gas mixtures by volumetric method.*

Traceability.

All BOC calibration gas standards are traceable to national or international standards, through an unbroken chain of comparisons, all having stated uncertainties. This is your assurance that your HiQ[®] gas mixture is a world class product. Traceability is assured by one of the following routes:

- a) Direct traceability to Standard Reference Materials.
 BOC has a library of standard reference materials from international metrology institutes including NIST (USA), VSL (Netherlands), NPL (UK) and NMI (Australia).
- b) Traceability to Standard Reference Weights. BOC chemists have produced a range of HiQ[®] PRIMARY GRAVIMETRIC STANDARDs which are traceable to the national standard of mass.

Traceability chain



Calibration Curve







HiQ[®] 60 and SPECTRA-SEAL[®] stability guarantee.

With calibration gas mixtures, it is essential that the reported value of a specific component is accurate for the life of the product. Products with a limited shelf life can result in additional cylinder change-out and expensive recalibration procedures. HiQ[®] Standards with the HiQ[®] 60 stability guarantee from BOC remove these concerns by offering accurate, stable gas products with a full 60 month performance guarantee.

The HiQ[®] 60 stability guarantee is available for both HiQ[®] PRIMARY GRAVIMETRIC STANDARDS and HiQ[®] CERTIFIED CALIBRATION STANDARDS. It is applied to mixtures with non-reactive components in concentrations over 5 ppm and mixtures with reactive components in concentrations over 1%.

The SPECTRA-SEAL[®] stability guarantee is available for HiQ[®] CERTIFIED CALIBRATION STANDARDS. It is applied to mixtures with Carbon Monoxide (CO), Nitric Oxide (NO), and Nitrogen Dioxide (NO₂) in concentrations from 5 ppm to 1%.

Shelf Life Summary

HiQ[®] 60 Stability Guarantee

SPECTRA-SEAL[®] Stability Guarantee

| Concentration | Non-reactive | CO, NO, NO ₂ | NH ₃ , SO ₂ , H ₂ S, mercaptans, etc |
|---------------|--------------|-------------------------|--|
| >1% | 60 | 60 | 60 |
| >5ppm-1% | 60 | 60 | 24 |
| >1–5 ppm | 24 | 24 | On application |

NATA and IANZ accreditation.

Every HiQ[®] standard is supplied with an individual NATA or IANZ accredited certificate to ISO Guide 34:2009 standard *'General requirements for the competence of reference material producers.'* Each certificate reports composition and certification uncertainty. Our HiQ[®] certificates are your record of quality and accuracy.

Gas mixture technology.

BOC's leadership in the special gases field is based on our process excellence through the following:

- → Pre-fill preparation and compatible cylinder material selection
- → Mixture stability and shelf life
- → Traceability to international standards and analytical accuracy

Technical Specifications

| Concentration | Preparation Tolerance | Certification Uncertainty* |
|-----------------------------------|--------------------------|-------------------------------|
| HiQ [®] PRIMARY GRAVIN | NETRIC STANDARD (PGS) | |
| > 50% | On application | On application |
| ≥1-50% | ±5% relative | ±0.5% relative |
| ≥100ppm-1% | ±5% relative | ±1% relative |
| <100 ppm** | ±10% relative | ±1–2% relative |
| HiQ [®] CERTIFIED CALIBR | ATION STANDARD (CCS) | |
| > 50% | On application | On application |
| >10-50% | ±5% relative | ±2% relative |
| >100ppm-10% | ±10% relative | ±2% relative |
| > 5–100 ppm | ±20% relative | ±5% relative |
| ≤ 5 ppm** | ±20% relative | ±5–10% relative |

*May vary for low molecular weight gases and low pressure mixtures ** Concentrations <1 ppm on application only

Process application mixtures.

HiQ[®] SPECIAL APPLICATION MIXTURES.

HiQ[®] SPECIAL APPLICATION MIXTURES are used for process applications, such as blanketing, instrument support gases, leak detection and creation of biological atmospheres. They are not suitable for calibration purposes. Cylinders can be supplied with or without an individual or batch certificate.

Technical Specifications

| Concentration | | Preparation Tolerance | Certification Uncertainty |
|---------------|-------------------------------|--------------------------|------------------------------|
| | HiQ [®] SPECIAL APPL | ICATION MIXTURE (SAM) | |
| | > 1 % | ±10% relative | ±5% relative |
| 1 | | | |



Specification explained.

Definitions of terminology.

Two key terms are commonly used by BOC when describing the technical specifications of different mixtures; preparation tolerance and certification uncertainty.

Preparation/Filling Tolerance: This is the acceptable range established by BOC for gas mixtures. The range is governed by what is practicably achievable within the constraints imposed by filling processes and equipment.

Certification/Analytical Uncertainty: This is the accuracy of the result. Any process or analytical equipment has an inherent variation or uncertainty. The analytical uncertainty captures this variation and provides a range within which the true result will fall. Although certification uncertainty is generally quoted in product specifications as a relative value, BOC will always calculate the combined uncertainty and quote this value on the certificate.

These terms are more easily explained using an example.

Example

| Mixture Requested | HiQ [®] CERTIFIED CALIBRATION STANDARD, 8% Carbon Dioxide in Nitrogen |
|---------------------------|---|
| Analysis Result | 8.25% Carbon Dioxide |
| Technical Specifications | |
| Preparation Tolerance | ±10% relative |
| Certification Uncertainty | ±2% relative |
| | |

- 1 BOC fills a cylinder using calculations to determine the amount of Carbon Dioxide and Nitrogen that need to be added to achieve a mixture of 8% Carbon Dioxide in Nitrogen.
- 2 The cylinder contents are then homogenised and the cylinder taken to the laboratory and the Carbon Dioxide content analysed.
- **3** In the example above the analysis result was 8.25%. The chemist refers to the technical specifications to determine

whether this result is within the preparation range of the mixture.

In this example the preparation tolerance is $\pm 10\%$ relative, giving a preparation tolerance acceptance window of 7.2–8.8%. The analysed concentration of the mixture is 8.25% which falls within this preparation range so this mixture would be released.

4 The chemist will now prepare the certificate. As both reference standards and analytical equipment have an element of uncertainty, it is important to ensure that the total analytical uncertainty meets the technical specification. The certificate will record the actual result and its calculated combined uncertainty.

In this example the analytical uncertainty is $\pm 2\%$ relative and the actual result is 8.25%.

The certificate will state the result as Carbon Dioxide $8.25 \pm 0.17\%$.





Certificate of analysis Image is for illustrative purposes only.

Setting standards.

Precision matters... in setting standards. BOC is committed to the excellence of our products and services, underlined by our accreditation to international standards on quality, safety and environmental management.









Taking a liquid sample for analysis.

ISO 17025 for competence in testing.

BOC specialty gas facilities in Australia and New Zealand are certified to ISO 17025:2005 as testing 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 17025:2005 specifies the general requirements for the competence to perform tests, including sampling. It covers testing and calibration performed using standard and in house methods and is applicable to all organisations undertaking analytical work.

ISO Guide 34:2009 for reference material production.

According to ISO Guide 34:2009 'General requirements for the competence of reference material producers' a reference material is produced using a metrologically valid procedure for one or more specified properties (typically this is the concentration of the calibration gas mixture components). It will be accompanied by a certificate that provides the value of the specified property (composition), its associated uncertainty, and a statement of metrological traceability.

HiQ[®] specialty gas facilities in Australia and New Zealand have received accreditation to this standard by NATA or IANZ. This allows BOC to confidently state that the methods used to certify our reference standards are traceable, accurate, consistent, documented and validated. It also provides you with the highest level of quality assurance.

ISO 9000 and 9001 for end-to-end quality.

BOC has a quality management system meeting the requirements of the ISO 9000:2000 series of standards, regularly assessed and approved by independent auditors.

Recognised around the world, ISO 9000:2000 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.

BOC facilities are also ISO 9001:2000 certified, demonstrating that our quality control procedures are regularly subjected to scrutiny by independent auditors. We are also committed to continuous improvement, based on the evolving needs of our customers and their feedback. BOC has had more than 250 facilities worldwide certified since 1988. In Australia and New Zealand, all special gases filling facilities have ISO 9001:2000 certification.

Further ISO compliance.

In order to ensure that all gas mixtures are produced to the quality standards expected by customers BOC also complies with the following ISO standards where applicable:

- → ISO 6141 Requirement for certificates for calibration gas mixtures.
- → ISO 6142 Gas analysis. Preparation of calibration gas mixtures. Gravimetric method.
- → ISO 6144 Preparation of calibration gas mixtures by volumetric method.
- → ISO 6976 Specified method for the calculation of the calorific value and the Wobbe index of dry natural gas and other combustible gaseous fuels.

HiQ[®] specialty gas equipment.

Precision matters... in our gas equipment. When using gas for analysis and high-tech production, it's essential to maintain the integrity of your gas between your gas source and point of use. The quality of your gas is only as good as the quality of your distribution system.



Steps to maintaining gas purity.

- Use high purity gas equipment.
- Use qualified engineers with specialty gas expertise and knowledge to design and install your gas reticulation system.

When precision matters, choose HiQ[®] specialty equipment from BOC.

HiQ[®] specialty equipment.

BOC offers two ranges of high purity gas equipment:

- → BASELINE[®] cylinder regulators.
- → REDLINE[®] gas supply systems. Available when installed by BOC Customer Engineering Services.

BASELINE[®] cylinder regulators.

- \rightarrow Entry point into the world of specialty gas equipment.
- \rightarrow Internal components designed to maintain gas purity.
- \rightarrow Suitable for gas purities of up to grade 5.0 (99.999%).
- \rightarrow Complements the specialty gases supplied by BOC.

REDLINE[®] gas supply systems.

BOC's high purity REDLINE® installation includes;

- → REDLINE[®] gas panel regulators.
- \rightarrow REDLINE[®] points of use.
- → Gas reticulation.
- → Planning, design, installation and maintenance by BOC Customer Engineering Services (CES).

REDLINE[®] components are suitable for use with gas purities up to grade 6.0 (99.9999%). BOC provides a one-stop solution for all your specialty gas projects.

BASELINE[®] Regulators. Simple solutions for purity.

BASELINE[®] cylinder regulators are designed for more stable operation than industrial equipment can provide. The BASELINE[®] range is suitable for gas purities of up to 5.0 and is designed to complement the specialty gases supplied by BOC. As such, both stainless steel and brass options are available to suit corrosive and non-corrosive gases.

BASELINE[®] regulators will give you peace of mind, knowing that your high purity gases are being delivered according to the original specification.



BASELINE® single stage regulator.



BASELINE[®] dual stage regulator.

Your needs are our top priority.

An important element of a high purity regulator is to maintain the integrity of the gas from the cylinder to the point of use. Not all applications will require a complex gas supply system, sometimes all that is needed is a cylinder regulator. For situations in which high quality is crucial but start-up speed and simplicity are of equal importance, BOC has developed the BASELINE[®] range.

In order to meet the wide variety of applications of our customers, both dual stage and single stage regulators are available in the BASELINE[®] range. A variety of outlet pressures are available and the regulator can be equipped with either a $\frac{1}{8}$ inch or $\frac{1}{4}$ inch compression outlet fitting.

Benefits of BASELINE[®] cylinder regulators.

BASELINE[®] regulators have bar stock bodies. All surfaces in contact with the gas stream have been machined to ensure a smooth finish. This minimises particle shedding, reducing a potential source of contamination, and allows for quick and easy purging of the regulator. The diaphragm in BASELINE[®] regulators is 316L Stainless Steel, preventing impurities from diffusing into the regulator and contaminating the gas. It also ensures that the high value gas passing through the regulator is not lost.

Technical Data

| Outlet Connection | $\frac{1}{4}$ " compression fitting [†] |
|------------------------------|--|
| Material | |
| Housing | Brass, Ni/Cr plated or Stainless steel 316L |
| Seals | PTFE |
| Membrane | Stainless Steel 316L |
| Helium Leak Integrity | 1 x 10 ⁻⁸ scc/sec |
| Seating | PTFE |
| tOther outlets are available | |

[†]Other outlets are available

Part Numbers - Dual Stage Brass Regulators*

| | Delivery Pressure | | |
|------------------------|------------------------------|----------------|--|
| Gas | 0–50 psi | 0–150 psi | |
| Air | \$5629-516-285 | \$5631-516-285 | |
| CO ₂ | \$5629-516-263 | S5631-516-263 | |
| Ar, He, O ₂ | \$5629-516-255 | S5631-516-255 | |
| H ₂ | \$5629-516-259 | S5631-516-259 | |
| N ₂ | \$5629-516-281 | \$5631-516-281 | |
| Mixtures | Contact BOC for part numbers | | |
| ter I loverune® | | | |

*Standard BASELINE® range. Other regulators available on request.

REDLINE[®] Solutions, service and expertise. The benefits of using REDLINE[®] supply systems.



Premium products for premium users.

Impurities occurring in just a few parts per million (ppm) can have serious consequences when trying to meet the increasing demands for high standards of accuracy, performance and production refinement.

REDLINE[®] gas supply equipment is the preferred choice for high-performance and purity-sensitive specialty gas applications. A REDLINE[®] system guarantees that the integrity of the HiQ[®] specialty gas in your system is not jeopardised.

In your laboratory or production facility, quality, safety, efficiency, reliability, ergonomics and economy are vital to success. A central specialty gas supply system installed by BOC's team of expert engineers (CES) using REDLINE[®] equipment ensures that all these factors are covered. As a one-stop solution provider, BOC designs and installs these systems in accordance with your requirements.

Expertly maintained.

Every REDLINE[®] supply system includes the convenience and reliability of CES maintenance. To ensure the continued performance of a specialty supply, BOC offers the following services:

- → Maintenance planning and engineering
- → Planned and corrective maintenance
- → Incident response management

High safety standards.

CES ensures that all installation and service work is carried out in accordance with BOC's strict safety standards, including full hazard and risk assessments prior to work commencing.

Features of REDLINE[®] specialty gas equipment.

- → Ergonomic control knobs with indicators for increased or reduced flow/pressure
- → Quarter turn valves give a clear indication of open or closed position
- → Reduced risk for error in coupling due to etched markings for inlet and outlet connections
- \rightarrow All components are tested for function and tightness

Benefits of REDLINE[®] specialty gas equipment.

- → All REDLINE[®] components are designed for use with gas purities up to grade 6.0 (99.9999%)
- → REDLINE[®] regulators provide enhanced pressure and flow stability on the secondary side despite fluctuating inlet pressure
- → The shut-off valves are of diaphragm type, designed to allow large flows of both high and low pressures
- → The finely threaded, bellow sealed regulating valves allow accurate flow control
- → The dependable, leak resistant and durable diaphragms are made from Hastelloy[®]
- → REDLINE[®] cylinder regulators, points of use and gas panels are manufactured, tested and delivered in compliance with Australian and international standards
- → Housing: Stainless Steel 316L or Brass, Ni/Cr plated

Precision matters in everything we do. REDLINE[®] equipment for you.



Double gas panel.



Point of use for bench mounting.



REDLINE[®] equipment is a modular system which allows maximum flexibility when designing, installing or retrofitting your individual specialty gas supply system.

Gas panels.

In central gas supply systems, gas panels are used to reduce the high primary pressure in gas cylinders or cylinder bundles to more manageable secondary pressures. BOC offers three types of REDLINE[®] panels: single, double and semi-automatic. For full technical specifications refer to the REDLINE[®] datasheets available on precisionmatters.com.au

Points of use.

Together with the gas panel, the point of use guarantees a stable outlet pressure. Each REDLINE® point-of-use assembly can be individually equipped with the functions "shut-off", "pressure regulation" and "flow regulation". That way, the points of use at the work stations can be retrofitted any time to meet new requirements. BOC offers various REDLINE® point of use models for different installation types, e.g. wall, bench, panel or fume cupboard mounting. For full technical specifications refer to the REDLINE® datasheets available on precisionmatters.com.au

Tested for reliability, integrity and safety.

Pressure testing is carried out according to applicable standards and a corresponding protocol is compiled. The complete system is purged and cross checked. To guarantee that the system is tight, we carry out a leak detection test, which is documented in a Test and Completion certificate. A complete system, however, does not only contain piping and components, it also consists of various engineered safety features. For instance, flammable gases such as hydrogen require flash back arrestors and excess flow valves. Most systems are also equipped with safety relief and check valves. Some installations also require fixed and personal gas alarms combined with computerised surveillance systems.

The specialty gas expertise and knowledge of BOC's engineers ensures that your gas reticulation system is not only designed to meet your needs but is designed to meet the highest standards of safety.

Partnering with BOC.

At BOC we help our customers to create added value, clearly discernible competitive advantage and hence greater profitability. To achieve this we have a comprehensive range of products, services and technical support which can be customised to meet the individual requirements of our customers.

We provide our customers with an extensive range of safe delivery and supply options, delivering gas cost-efficiently and effectively.

We are there for you and with you, helping to build your success.

BOC's reputation has been forged through partnerships – with customers, with relevant regulatory authorities and with key suppliers. In this way, we deliver comprehensive and consistent benefits to you.

BOC - world-leading knowledge and resources adapted to local requirements.

For more information contact the BOC Customer Engagement Centre on:

BOC Australia 1800 658 278

BOC New Zealand 0800 100 949

BOC Limited ABN 95 000 029 72 10 Julius Avenue, North Ryde NSW 2113, Australia www.boc.com.au

BOC Limited WN007748 970–988 Great South Road, Penrose, Auckland, New Zealand www.boc.co.nz