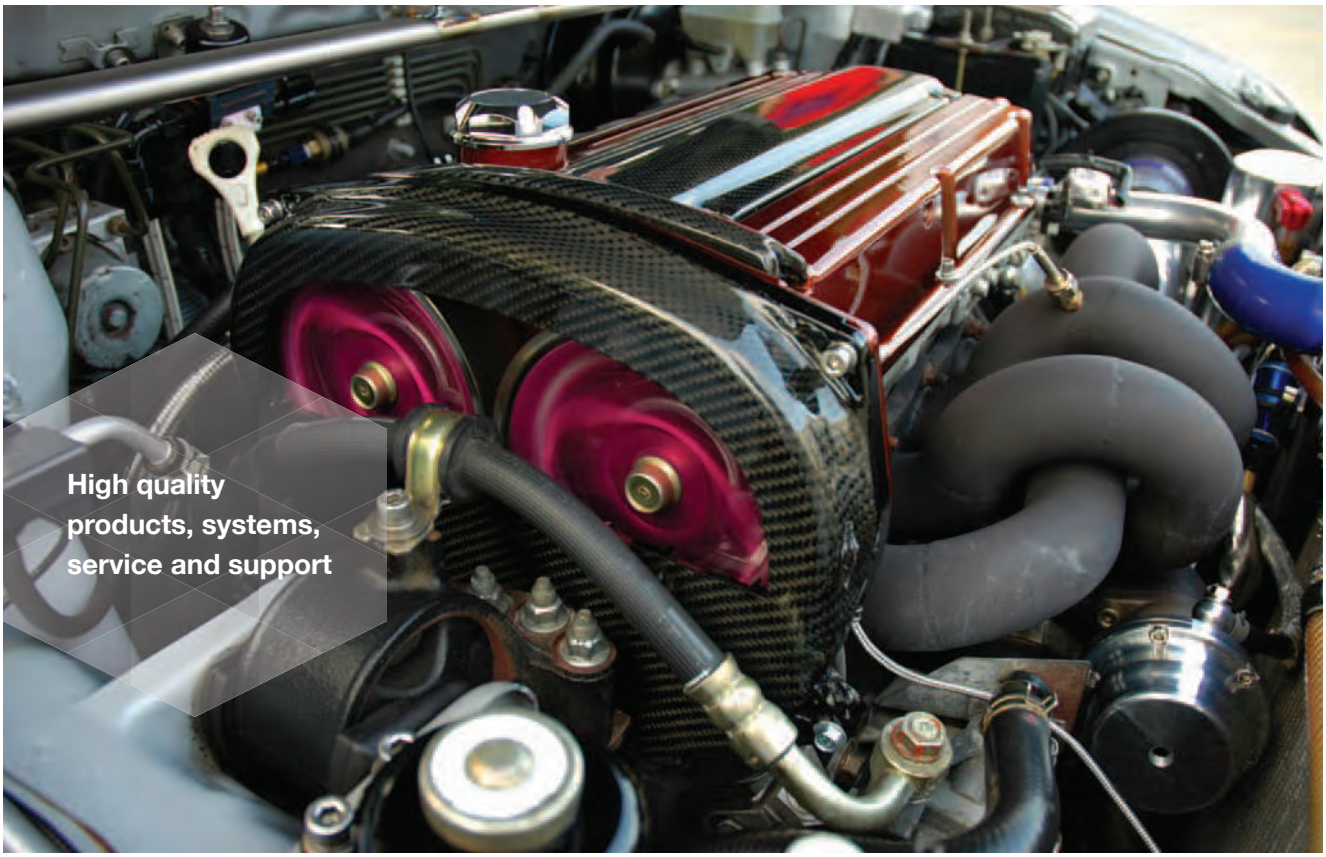
# Engine Emissions

## Overview






### The Praxair Advantage

As the largest industrial and specialty gases company in North and South America, and one of the largest worldwide, we provide accurate, reliable NIST traceable calibration gases that meet or exceed regulatory standards for your engine bench testing needs. From supplying repeatable, high quality gases, to designing and installing our state-of-the-art *ProSpec*™ Gas Delivery Systems, you can count on Praxair for consistent high quality products, systems, service and support.

Praxair is a pioneer in producing highly accurate calibration gas standards and ultra pure zero gases for engine emissions testing. Our environmental solutions help ensure regulatory compliance, increase capacity, improve economics and achieve a broad range of environmental benefits.

Our emissions testing products are developed in compliance with the current regulatory requirements of Federal, Provincial, State and local air quality authorities.

When you choose Praxair, you get a single, proven supplier of consistent high-quality products and services for your engine emissions testing needs.

- Single point of contact for all your engine emissions testing needs.
- Comprehensive, repeatable product line of certified pure gases and multi-component calibration mixtures.
- NIST traceability ensures +/-1% accuracy for mixtures; Certificate of Analysis.
- Turnkey project management, including design and installation of *ProSpec* Gas Delivery Systems.
- Outstanding technical support through a highly trained team of field representatives, technical service personnel and production chemists that support your regulatory, technical and safety needs.
- Cylinder management and local stocking programs that lower cost and meet supply demand.
- Reliable production and distribution network with over 20 specialty gases laboratories/production centers and over 400 distribution centers throughout North America.
- Praxair's worldwide ISO 9001: 2000 and ISO 17025 certified facilities ensure mixtures are internationally traceable and consistent.

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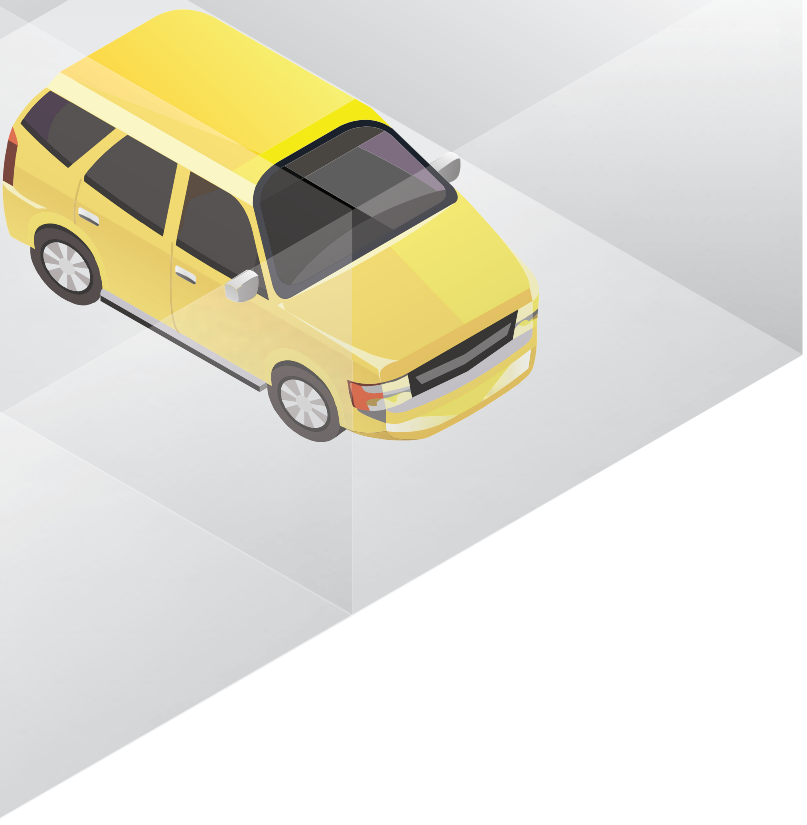
1 **6, 12 or 18 Cylinder Gas Packs**
Convenience of large volume supply increases productivity by eliminating swapping out individual cylinders.

2 **UHP Gas Cabinet**
Safest and most reliable means to deliver hazardous and non-hazardous gases.

# Engine Emissions

## Equipment



**3** **Protocol Stations**
Convenient wall mounting provides ease of use, prevents regulator damage and improves safety.

**4** **Gas Blending System**
Computerized multi-component gas blender mixes gases to generate precise gas mixtures for analytical purposes.

**5** ***StarGen™* Oxygen Generator**
Continuous supply of ultra-high purity $O_2$ (99.9999%) minimizes cylinder-to-cylinder variation and analyzer down time. Zero Air and Nitrogen generators available.

**6** **High Purity Orbitally Welded Piping**
Design and installation of high purity gas delivery systems that can help you ensure gas quality from source of supply to point of use.

**7** **Multi-Gas Point-of-Use Panel**
Allows gas to be effectively pressure-controlled to one or multiple instruments or use points.

**8** **Racking System**
Custom-designed racks incorporate point-of-use control with the instruments to increase efficiency in the workspace.

**See our complete line of gas handling solutions in Section E**

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## Mobile Source Emissions Standards

Federal, Provincial and State vehicle emission regulations require certification of tailpipe emissions to prescribed levels. These regulations mainly deal with in-use certification for currently owned and licensed on-road vehicles.

High pressure precision gas mixtures, in various concentrations, are also supplied to original equipment manufacturers for new engine certification of internal combustion engines (ICE).

A wide range of high purity gases and calibration standards, blended to the manufacturers exacting specifications, are available.

In-use testing is traditionally referred to as Inspection and Maintenance (I/M) testing. I/M automotive calibration standards are referred to as "BAR" mixtures, and are defined by the California Bureau of Automotive Repair.

### BAR Certified I/M Automotive Calibration Standards

| Mixture (Praxair Part Number) | Carbon Dioxide | Carbon Monoxide | Propane | Nitric Oxide | Balance Gas | BAR Blend Code | Analytical Uncertainty |
|---|---|---|---|---|---|---|---|
| BAR-90 Low (MS BAR90L-D7) | 6.0% | 1.0% | 300 ppm | N/A | Nitrogen | 11 | ± 2%(1) |
| BAR-90 Mid (MS BAR90M-D7) | 12.0% | 4.0% | 1,200 ppm | N/A | Nitrogen | 12 | ± 2%(1) |
| BAR-97 Low w/NO (MS BAR97LNO-D7) | 6.0% | 0.5% | 200 ppm | 300 ppm | Nitrogen | 32 | ± 1%(2) |
| BAR-97 Low (MS BAR97L-D7) | 6.0% | 0.5% | 200 ppm | N/A | Nitrogen | 31 | ± 1%(2) |
| BAR-97 High w/NO (MS BAR97HNO-D7) | 12.0% | 8.0% | 3,200 ppm | 3,000 ppm | Nitrogen | 35 | ± 1%(2) |
| BAR-97 High (MS BAR97H-D7) | 12.0% | 8.0% | 3,200 ppm | N/A | Nitrogen | 34 | ± 1%(2) |

### BAR 97 Zero Air

| Mixture (Praxair Part Number) | Total Hydrocarbons | Carbon Monoxide | Carbon Dioxide | Nitric Oxide | Oxygen | Balance Gas | BAR Blend Code |
|---|---|---|---|---|---|---|---|
| BAR-97 Zero Air (MS BAR97ZA-D7) | < 1 ppm | < 1 ppm | < 1 ppm | < 1 ppm | 20.9% | Nitrogen | 37 |
| BAR-97 Zero Air (MS BAR97ZA-AS)(3) | < 1 ppm | < 1 ppm | < 1 ppm | < 1 ppm | 20.9% | Nitrogen | 45 |

Listed are the most commonly used mixtures. Please contact your Praxair Sales Representative for additional BAR certified mixtures.

Mixtures with a D7 suffix in the part number are supplied in single use, low pressure transportable cylinders.

(1) Labeled at the nominal (listed) concentrations.
(2) Labeled at the analyzed concentrations.
(3) High pressure aluminum AS cylinder available for operational savings.

# Engine Emissions

## FID Fuel



### Flame Ionization Detector (FID) Fuel

| Part Number | Product Description | Mixture Application Style | Cylinder Style | CGA |
|---|---|---|---|---|
| IG FI1-K | 40% $H_2$ in He (FID Fuel) (THC < 0.5 ppm) | Fuel Gas for GC-FID | K | 350 |
| IG FI2UH-K | 40% $H_2$ in He UHP (FID Fuel) (THC < 0.1 ppm) | Fuel Gas for GC-FID | K | 350 |
| IG FI3-K | 40% $H_2$ in $N_2$ (FID Fuel) (THC < 0.5 ppm) | Fuel Gas for GC-FID | K | 350 |
| IG FI4UH-K | 40% $H_2$ in $N_2$ UH (FID Fuel) (THC < 0.1 ppm) | Fuel Gas for GC-FID | K | 350 |
| IG FI1065-K* | 39 - 41% $H_2$ in He (FID Fuel) (THC ≤ 0.05 ppm) | Fuel Gas for GC-FID | K | 350 |
| IG FI31065-K* | 39 - 41% $H_2$ in $N_2$ (FID Fuel) (THC ≤ 0.05 ppm) | Fuel Gas for GC-FID | K | 350 |

* Complies with Title 40 Part 1065.750

Instument mixtures are supplied as certified standards, but also may be produced to meet primary standard or non-certified grade specifications.

Other cylinder styles are available upon request.

### 7000 Series Gas Cabinet

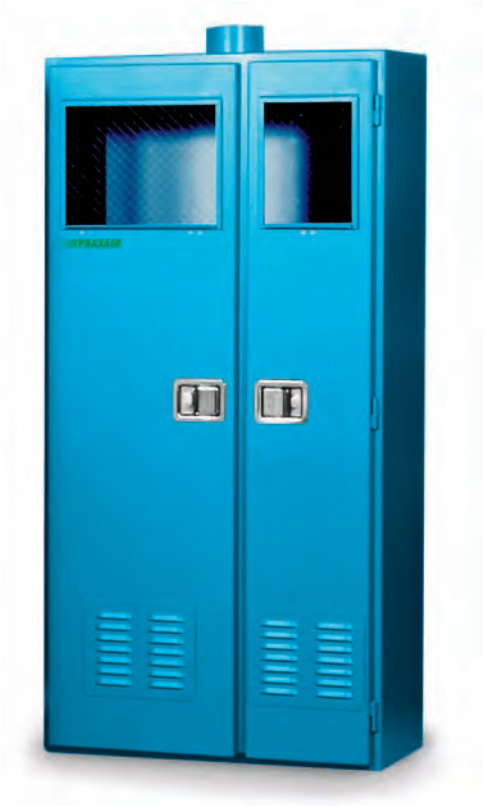
The 7000 Series gas cabinet enclosures are used to store gas cylinders and to mount gas delivery panels for the safe use of hazardous gases. They provide a low cost method to contain any gas releases and achieve compliance of NFPA Standards municipal and customer safety codes.

#### Features and Benefits

- Safe storage of compressed gases and delivery systems.
- Gas releases are contained and vented to an exhaust system away from workers.
- Optional Gas leak detection systems can be linked to an alarm and/or emergency shutoff.
- Safe use, dispensing and handling of hazardous gases.
- Clean laboratory appearance, since cylinders are kept inside enclosure and not in the workplace.
  - Meets NFPA requirements

#### Design and Construction Features

- Doors and windows that close and latch automatically; exhaust vent located on top of cabinet.
- Air inlet louvers.
- Internal UL approved fire sprinkler with protective coating.
- Adjustable cylinder brackets.



*See page E•305 for complete details.*

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| Name | Part Number | Cylinder Style | $O_2$ | $H_2O$ | $CO_2$ | CO | THC | $NO_X$ | $N_2O$ | $SO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|
| Ultra Zero Ambient Monitoring | AI 0.0UM | AS, AQ, T, K, Q | 19.9 - 21.9% | < 2 | – | < 0.05 | < 0.05 | < 0.02 | – | – |
| Volatile Organic Compound Free | AI 0.0VC | AS, AQ, A3 | 19.9 - 21.9% | < 2 | < 0.03 | < 0.05 | < 0.01 VOC* | – | – | – |
| Vehicle Emissions Part 1065** | AI 0.01065 | AS, AQ, A3 | 20.5 - 21.5% | – | ≤ 10 | ≤ 1 | ≤ 0.05 | ≤ 0.02 | ≤ 0.02 | – |
| Continuous Emission Monitoring Zero | AI 0.0CE | AS, AQ, A3 | 19.9 - 21.9% | < 2 | < 1 | < 0.5 | < 0.1 | < 0.1 | – | < 0.1 |
| Vehicle Emission Zero | AI 0.0VE | T, K, AS, AQ | 18 - 21% | < 1 | < 1 | < 0.5 | < 0.1 | < 0.1 | – | – |
| BAR-97 Zero Air | MS BAR972A | D7, AS | 20.9% | – | < 1 | < 1 | < 1 | < 1 | – | – |
| Ultra Zero Air | AI 0.0UZ | T, K, Q | 19.5 - 23.5% | < 2 | < 0.5 | < 0.5 | < 0.1 | – | – | – |
| Zero | AI 0.0Z | T, K | 19.5 - 23.5% | – | – | – | < 1 | – | – | – |
| Extra Dry | AI 0.0XD | T, K | 19.5 - 23.5% | < 10 | – | – | – | – | – | – |

* Individually analyzed for customer selected VOC component(s).

** Complies with Title 40 Part 1065.750
Complies with Title 40 Part 86: 114.79 and EPA I/M 240.

For other applications, alternative specifications may apply.

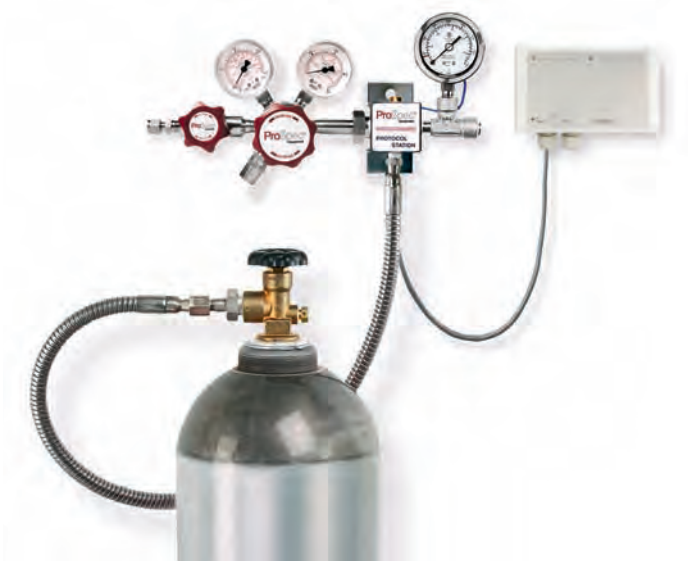
Concentrations given are ppm by volume unless otherwise specified.
Maximum ppm unless otherwise noted.

### Protocol Alarm Station

The 5029 Series Protocol Alarm Station combines all of the safety and features of a standard Protocol Station with the added security of a remote alarm system. See page E•283 for complete details.

#### Part Numbers

| | |
|---|---|
| Zero Air | PRS50291101-590 |
| Zero Nitrogen | PRS50291101-580 |

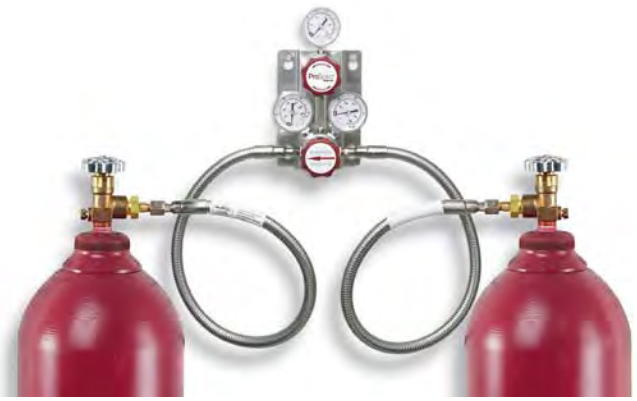


### High Purity Automatic Changeover System

The 5028B (Brass) and 5028S (316 Stainless Steel) Series high purity automatic switchover systems are designed to provide a continuous supply of high purity gases to the laboratory, process or instrument. See page E•286 for complete details.

#### Part Numbers

| | |
|---|---|
| Brass | PRS5028B |
| 316 Stainless Steel | PRS5028S |



# Engine Emissions

## Nitrogen

| Product/Grade | Purity Number | Part Style | Cylinder | $O_2$ | $H_20$ | $CO_2$ | CO | THC | NOx | $N_2O$ | $SO_2$ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| CEM Zero, 5.5 | 99.9995%* | NI 5.5CE | AS, AQ, A3 | < 0.5 | < 2 | < 1 | < 0.5 | < 0.1 | < 0.1 | – | < 0.1 |
| Ultra Zero Ambient Monitoring, 5.0(1) | 99.999%* | NI 5.0UM | T, K, AS, AQ | < 2 | < 2 | < 0.5 | < 0.1 | < 0.5 | < 0.02 | – | < 0.005 |
| Volatile Organic Compound Free, 5.0(2) | 99.999%* | NI 5.0VC | AS, AQ, A3 | < 2 | < 2 | < 0.3 | < 0.01 | < 0.1 | – | – | < 0.01 |
| Ultra High Purity, 5.0 | 99.999%* | NI 5.0UH | T, K, Q, | < 1 | < 3 | – | – | < 0.5 | – | – | – |
| Vehicle Emission Zero, 4.8(3) | 99.998%* | NI 4.8VE | T, K, AS, AQ | < 0.5 | < 1 | < 1** | < 0.5 | < 0.1 | < 0.1 | – | – |
| Vehicle Emission Zero (1065), 5.0(4) | 99.999%* | NI 5.01065 | T, K, AS, AQ | ≤ 2 | – | ≤ 10 | ≤ 1 | ≤ 0.05 | ≤ 0.02 | ≤ 0.02 | – |

* Argon free basis.
** Available with 315-385 ppm $CO_2$ on request.

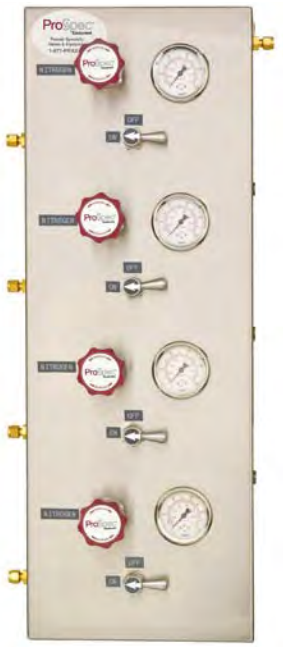
(1) $SF_6$ < 0.001 ppm.
(2) Can be individually analyzed for customer selected VOC components.
(3) Complies with Title 40 CFR 86 114.79. For other applications, alternative specifications may apply.
(4) Complies with Title 40 CFR Part 1065.750

Other Nitrogen grades available upon request.
Additional nitrogen grades are listed on page B•65.

Concentrations given are ppm by volume unless otherwise specified.
Maximum ppm unless otherwise noted.

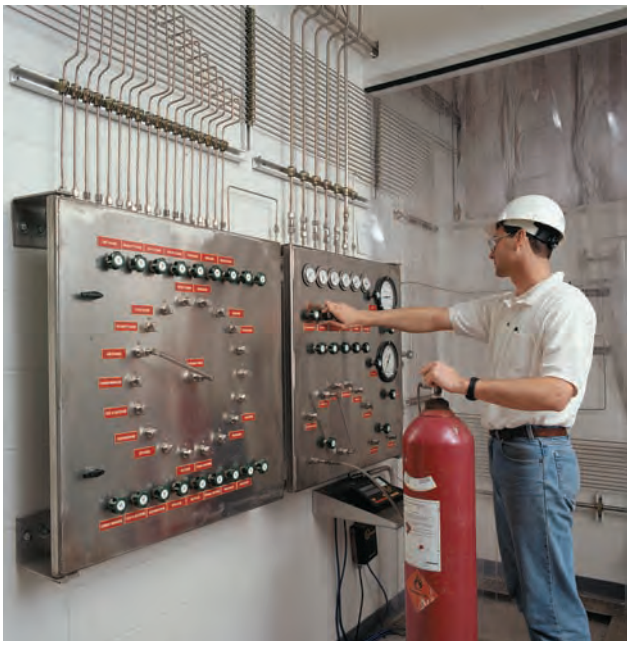
### Multi-Gas Point-of-Use Panels

Praxair's Multi-Gas Point-of-Use Panels allow gases to be effectively pressure-controlled to one or multiple instruments or use points in your test area. See page E•303 for complete details.



### High Purity Stainless Steel Tubing

High purity piping systems utilize 316L stainless steel that is orbitally arc welded to ensure the cleanest delivery system possible. High Purity Stainless Steel Tubing can be designed and integrated into any analyzer configuration and is EPA Part 1065 compliant. Contact your local Praxair representative for details.



# Engine Emissions

## Binary Mixtures

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| Component | Concentration Range | Balance Gas | Cylinder Style | Content ft³ (m³) | CGA Outlet Connection |
|---|---|---|---|---|---|
| Ammonia | 5 - 2500 ppm | Nitrogen | AS, AQ, A3 | 142 (4.00), 82 (2.30), 31 (0.90) | 705 |
| Carbon Dioxide | 100 ppm - 25% | Air | AS, AQ, A3 | 146 (4.13), 85 (2.41), 32 (.91) | 590 |
| Carbon Dioxide | 100 ppm - 20% | Nitrogen | AS, AQ, A3 | 142 (4.02), 82 (2.32), 31 (0.88) | 580 |
| Carbon Monoxide | 1 ppm - 6% | Air | AS, AQ, A3 | 146 (4.13), 85 (2.41), 32 (.91) | 590 |
| Carbon Monoxide | 1 ppm - 20% | Nitrogen | AS, AQ, A3 | 142 (4.02), 82 (2.32), 31 (0.88) | 350 |
| Ethanol | 20 - 500 ppm | Air | AS, AQ, A3 | 146 (4.13), 85 (2.41), 32 (.91) | 590 |
| Ethanol | 1 - 500 ppm | Nitrogen | AS, AQ, A3 | 142 (4.02), 82 (2.32), 31 (0.88) | 350 |
| Methane | 1 - 5000 ppm | Air | AS, AQ, A3 | 146 (4.13), 85 (2.41), 32 (.91) | 590 |
| Methane | 1 - 5000 ppm | Nitrogen | AS, AQ, A3 | 142 (4.02), 82 (2.32), 31 (0.88) | 350 |
| Nitric Oxide | 1 ppm - 2.9% | Nitrogen | AS, AQ, A3 | 143 (4.05), 82 (2.32), 31 (0.88) | 660 |
| Oxygen | .4 - 50% | Nitrogen | AS, AQ, A3 | 135 (3.82), 78 (2.21), 29 (0.82) | 580, 590, 296* |
| Propane | 1 ppm - 1.05% | Air | AS, AQ, A3 | 146 (4.13), 84 (2.38), 32 (.91) | 590 |
| Propane | 1 ppm - 13% | Nitrogen | AS, AQ, A3 | 142 (4.02), 82 (2.32), 31 (0.88) | 350 |

* CGA outlet connection varies with $O_2$ concentration.

Mixtures are NIST traceable and comply with applicable State, Provincial, and Federal Regulations.

Additional multi-component mixtures are available upon request.
Binary and multi-component mixtures compliant with Title 40 Part 1065.750 are available upon request.

Certificates of Analysis are available upon request.
Mixtures subject to availability.
Other cylinder styles are available upon request.

### Mobile Source Sectors Regulated by the EPA

- Aircraft
- Heavy-duty vehicles
- Light-duty vehicles
- Locomotives
- Motorcycles
- Marine compression-ignition (CI) engines
- Marine spark-ignition (SI) engines
- Non-road CI engines and equipment
- Non-road SI engines and equipment
- Non-road small SI engines and equipment
- Recreational engines and vehicles
- Alternative fuel vehicles and equipment