ProSpec™
by Praxair

PRAXAIR
Making our planet more productive

Specialty Gas and Equipment Solutions

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Contents by Section

Why Industry Leaders Choose Praxair

Trust. Track record. Integrity. Innovation. Unsurpassed reliability. Global capability.

These are among the many reasons businesses like you choose Praxair as their Specialty Gases supplier.

More than just an established leader in the manufacture and distribution of atmospheric, process, and specialty gases and equipment – Praxair helps ensure customers maximize their economic performance while minimizing their environmental impact.

That has been our focus and track record for over 100 years.

In fact, more than 20% of Praxair's revenue is generated by applications technologies that help customers reduce operating costs, increase process efficiencies and improve their environmental performance.

It's how Praxair, Inc. has become a Fortune 250 company, the largest industrial gas company in North and South America, and one of the largest worldwide.

This catalog provides information about Praxair's Specialty Gases, equipment, and capabilities – including descriptions of how our pure and mixture gases have helped customers work more productively and sustainably.

We invite you to have a look.

Introducing *ProSpec* by Praxair

ProSpec™ by Praxair is not simply a line of the highest quality Specialty Gases – it is a way of supporting your business and ensuring your success. Backed by the global infrastructure of Praxair, and the industry- leading experience and technical expertise of our teams, *ProSpec* by Praxair is all about meeting the most demanding requirements of customers like you.

Quality
With *ProSpec* by Praxair you can expect the highest quality pure gases and mixtures produced to the most ambitious environmental standards – complemented by an extensive line of gas handling and delivery equipment as well as a broad range of services. The result: a complete product supply solution for your business.

Innovation
ProSpec by Praxair leverages the latest technologies to develop new products and offerings. We then design those products based on your specific technical and regulatory requirements. This helps greatly enhance your opportunities to increase productivity while decreasing environmental impact.

Reliablity
This is about breadth and depth. Our wide-ranging global locations offer responsive customer service coverage while our deep product offerings and distribution capability ensure fast, cost-effective delivery. We provide product via common carriers, express carriers, and our own exclusive delivery systems. In short, we do whatever it takes.

Support
Our regional centers – staffed with highly trained product chemists, technical service personnel, and field sales representatives – provide answers to your questions and can assist you in resolving any regulatory, technical, and safety issues. We not only stand behind our products, we stand behind you.

Coverage
Everything we offer with *ProSpec* by Praxair is offered everywhere we are. For us, that means in 40 countries. For you it means world-class products, services, and peace-of-mind.

Praxair's Ecommerce Solutions

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Looking for ideas on how to take cost out of the supply chain management process…Praxair offers a variety of tools that you can choose from.

Praxair Connect is one of the many options that supports Punchout and Hosted Catalogs on leading E-Procurement portals such as SciQuest, Ariba, Oracle, Huboo etc. Level 3 invoicing, EDI and cXML.

For those who do not have a e-Procurement solution in place we have the answer. Praxair Express is an e-Commerce portal that makes transactions easy! Our eCommerce team will assist you with the best solutions to support your needs.

Platform Comparison

Features	Praxair Connect – Hosted Catalog	Praxair Express	Praxair Connect Punchout
Site Features			
Custom Storefront			X
Custom Contact Page			X
Ability to customize checkout process			X
Show contract items only	X		X
Robust product data		X	X
(M)SDS Links		X	X
Favorites Lists		X	X
View hardgoods inventory		X	
Search and compare items	X	X	X
Transactional Features			
EDI document exchange	X		X
Create Requisitions	X		X
No-Touch price updates		X	X
Past Transaction History	X (1)	X	X (1)
Electronic Order-to-Cash	X	X (2)	X
Account Management Features			
View cylinder balance		X	
E-Certificate of Analysis (ECOA)		X	X (3)
Export order history and invoices	X (1)	X	X (1)
View unpaid invoices	X (1)	X	X (1)

(1) Dependent on eProcurement/ERP system
(2) Dependent on payment method
(3) Planned feature

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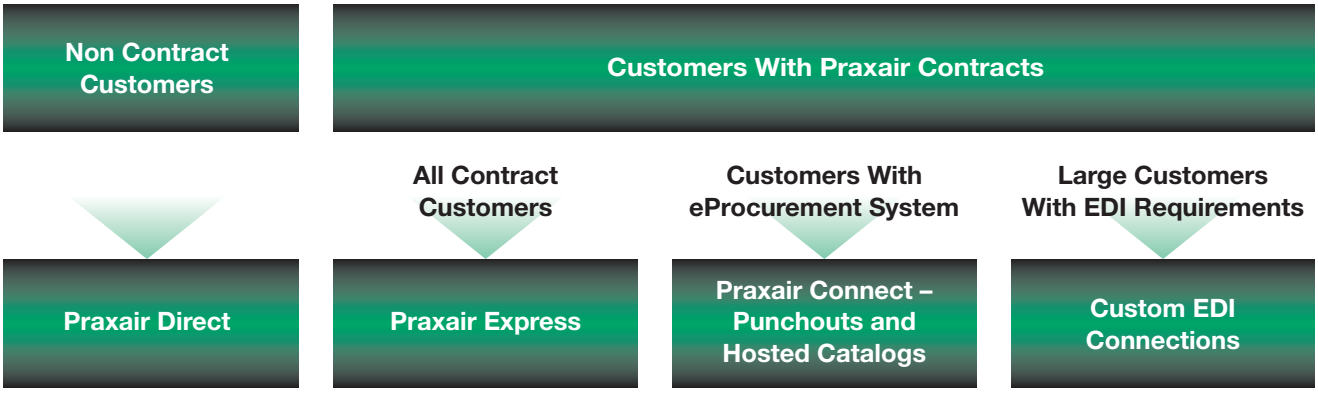
Productivity Tools



Praxair Direct – Shopping and Purchasing for Non-Contract Customers

If you do not have a contract with Praxair you can shop and order online at www.praxairdirect.com.

There you can:

- Browse current product catalogs
- Purchase from a selection of top-tier products
- Find the nearest store and all other contact information.
- Tap into the packaged gas expertise in our online information centers
- Access MSDS, safety, technical and application information
- Read industry news in our current news section.

Praxair Express – Shopping and Purchasing for All Contract Customers

Contract customers can have account management at fingertips.

With Praxair Express you can:

- Place orders with your contract pricing
- Search product availability
- Create custom groups of frequently purchased products
- Request special items
- Search order history
- Review financials and download unpaid invoices
- Download proof of delivery documents
- Check cylinder balances
- Retrieve eCOA and MSDS
- Find a local store

Just register your account at express.praxair.com using your existing account number.

Praxair Connect Punchouts for Contract Customers

For those who have invested in e-procurement systems as part of a strategic sourcing initiative, Praxair can align with your system. Compatible with many leading e-procurement software applications, Praxair Connect delivers a fully customized webstore that is integrated with your ERP system. We'll take care of the maintenance and updating of the site, while you get a webstore that has customized:

- Catalog content
- Contract pricing
- Delivery schedule
- Praxair account information

In addition to customized content, you'll get a first class shopping experience with convenient features like product search and compare, favorites lists, scheduled deliveries and access to Praxair MSDS database. We support PCards and electronic invoicing as part of our electronic order to cash process.

Praxair Connect Hosted Catalogs for Contract Customers

If you have e-procurement in place and prefer to host the catalog yourself, Praxair Connect offers buyer-hosted catalogs.

Our buyer-hosted catalog system is compatible with many leading e-procurement software applications, and delivers a customized catalog integrated with your ERP system.

Your catalog will have your contract pricing, and you will be able to search and compare products. We support PCards and electronic invoicing as part of our electronic order to cash process.

Contact
PraxairConnect@praxair.com

Custom EDI – Electronic Transactions for Contract Customers

If you want to take advantage of electronic services without catalog or shopping capabilities, consider EDI. Using EDI you can securely place orders, receive invoices and make electronic payments. Praxair supports all versions of EDI.

Contact info@praxair.com

Praxair Worldwide

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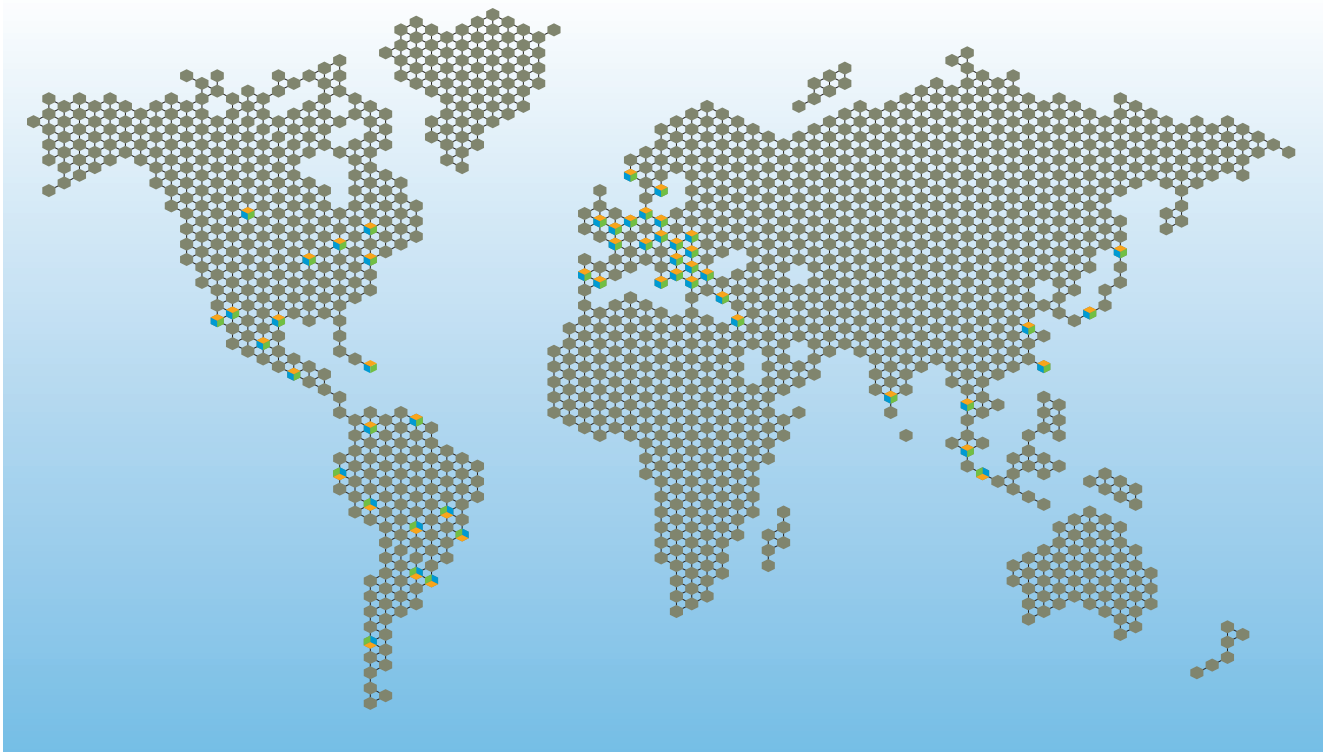

International Specialty Gases Major Production Facilities

North America
United States
Canada
Mexico
Puerto Rico

Central America
Costa Rica

South America
Argentina
Bolivia
Brazil
Chile
Colombia
Paraguay
Peru
Uraguay
Venezuela

Europe
Austria
Belgium
Bosnia-Herzegovina
Bulgaria
Croatia
Czech Republic
Denmark
France
Germany
Hungary
Italy

Europe
Netherlands
Norway
Portugal
Romania
Serbia-Montenegro
Slovakia
Slovenia
Spain
Sweden
Switzerland
United Kingdom

Middle East
Israel
Turkey

Asia
India
Malaysia
Japan
People's Republic of China
Singapore
South Korea
Thailand
Taiwan

Visit www.praxair.com/worldwide to access web sites for every country

Section

A

Cylinder Cross Reference Chart

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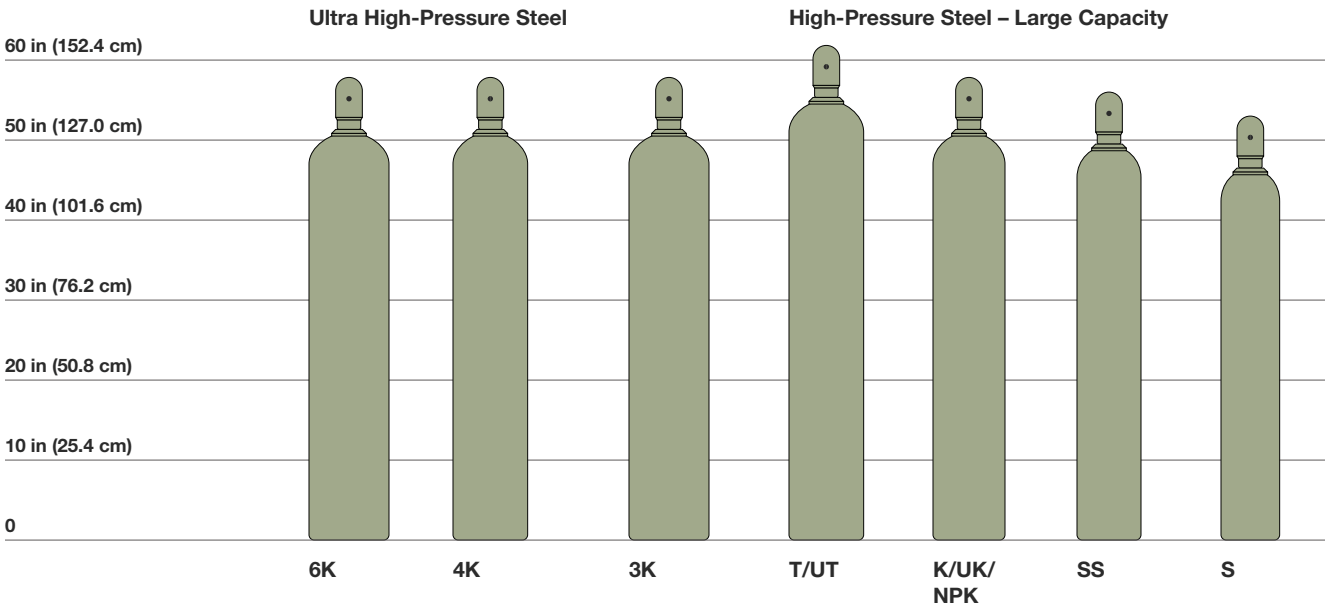
Dimensions	DOT Specification	Praxair	Airgas	Air Products	Air Liquide	Matheson	Linde	AGG
High Pressure Steel								
9.3" x 55"	3AA2400	T	300	A	49	1L/QK	49	49
9" x 51"	3AA2265/2015	K	200	B	44	1A/QA	44	44
10" x 51"	3AA3500	3K	2HP	–	44H	1H	43	–
10" x 51"	3AA6000	6K	3HP	BX	44HH	1U	46	–
7" x 31"	3AA2015	Q	80	C	16	2/GA	16	16
6" x 21"	3AA2015	G	35	D1	7	3/UA	7	7
4" x 17"	3AA2015	F/MD	10	D1	3	4/JA	3	3
4.2" x 7.25"	DOT39	C	–	–	1	–	–	2
2" x 12"	3E1800	LB/RB	LB	–	LB	LB	LBS	LB
2" x 12"	3E1800	EB	LBX	–	LBX	7X	LBR	–
4.5" x 31"	3AA2015	E	E	Med. E	Med E	–	OO5	5
High Pressure Aluminum								
9.8" x 52"	3AL2216	AT	–	–	47AL	–	–	AT
8" x 48"	3AL2015	AS	150A	B(AL)	30AL	1R/QX	A31	A31
7.25" x 33"	3AL2216	AQ	80A	C(AL)	16AL	2R/GX	A16	A16
6.9" x 15.6"	3AL2216	A3	33A	DL(AL)	7AL	3R/UX	A07	A07
5.25" x 17.1"	3AL2015	A3/AH	–	–	3AL	–	–	A07/7A
3.2" x 11.8"	3AL2216	AG	–	–	1AL	–	–	–
Low Pressure Cylinders								
15" x 55"	4BA240	FS	400	AA	125	1K	126	–
15" x 45"	4BA240	FX	350	A1	110	1F	350	–
12" x 44"	4BA240	A8	380	–	70	1B	110	–
12" x 32.5"	4BA240	–	–	–	40 LP	–	L60	–
12" x 32"	4E240	–	–	–	40 LPAL	–	–	–
12" x 18"	4BA240	–	25	–	22 LP	–	L20	–
12" x 21"	4E240	–	–	–	22 LP AL	–	–	–
9" x 17"	4BA240	–	–	–	11 LP	–	–	–
10" x 16"	4E240	–	–	–	11 LP AL	–	–	–
Low Pressure Steel								
29.75" x 55"	4BW-240	HT	–	A-5	–	–	–	454
15" x 52"	4AA-480	FA	–	AA	–	–	–	126
10" x 48"	3A-480	CL	–	A	57	1V	–	54
10" x 47"	4BA-300	FC	65	A-3	55	1J	–	–
12" x 51"	8AL	A5	380	A(C2H2)	70	1B	–	–
15" x 45"	4BA-240	FX	110	425	A-1	IF	–	–
12" x 17.66"	4BA-240	LP5	–	–	–	–	–	LP20

Compressed Gas Cylinders

	Ultra High-Pressure Steel			High-Pressure Steel – Large Capacity			
Part Number Code	**6K**	**4K/HC-500**	**3K**	**T/UT**	**K/UK/ NPK**	**SS**	**S**
Transport Canada Specifications	3AAM-459	SU-4221	3AAM-275	3AAM-183	3AM-154 3AAM-154	3AM-154	3AAM-154
DOT Specifications	3AA-6000	E9421-4500	3AA-3600	3AA-2400	3A-2015	3A-2015	3A-2015
Internal Volume							
ft^3	1.51	1.61	1.55	1.75	1.55	0.97	0.961
L	42.8	45.6	43.9	49.6	43.9	27.5	27.2
Water Capacity							
lb	94.3	100.5	96.8	109.3	96.8	60.6	60.0
kg	42.8	45.6	43.9	49.6	43.9	27.5	27.2
Nominal Dimensions							
Diameter (in)	10.0	9.25	10.0	9.25	9.0	7.5	7.37
Diameter (cm)	25.4	23.5	25.4	23.5	22.9	19.1	18.7
Height (in)	51.0	51.0	51.0	55.0	51.0	49.0	46.0
Height (cm)	129.5	129.5	129.5	139.7	129.5	124.5	116.8
Average Tare Weight							
lb	303	145	189	143	133	110	76
kg	137	65.8	85.7	64.9	60.3	49.9	34.5

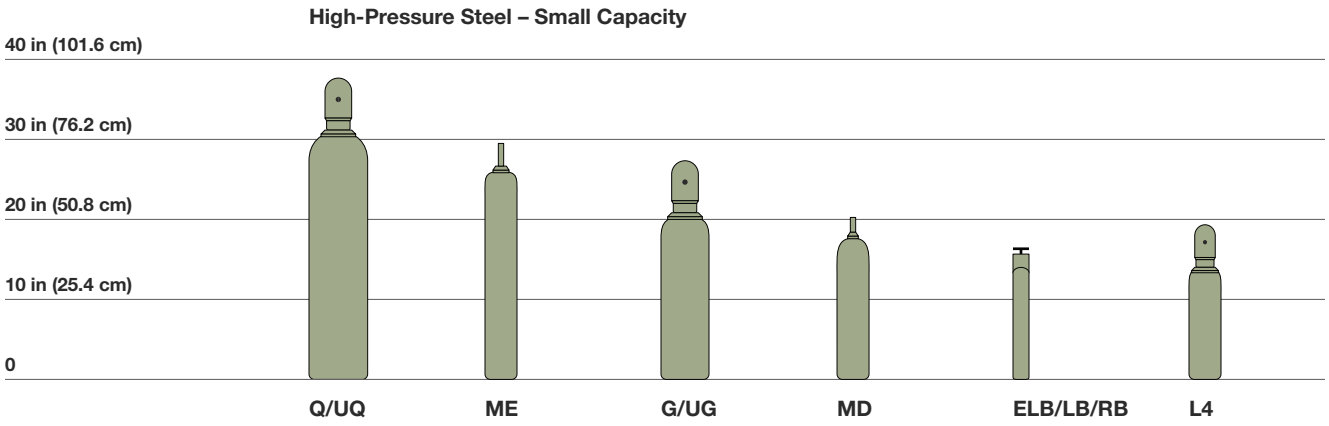
Note: Dimensions and capacities are approximate and may vary slightly.



Compressed Gas Cylinders

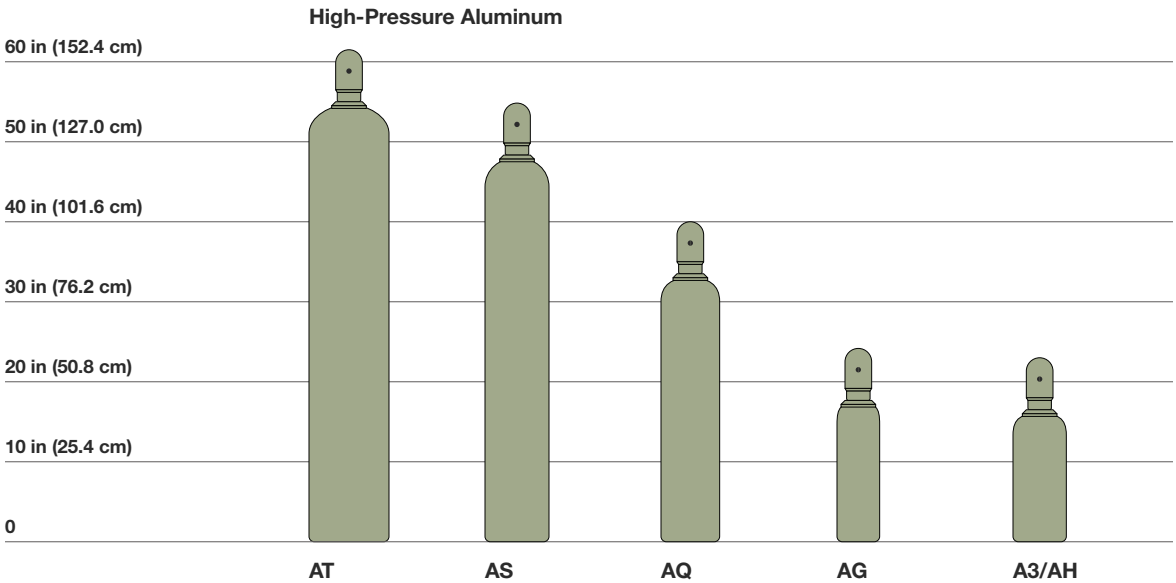
	High-Pressure Steel – Small Capacity					
Part Number Code	**Q/UQ**	**ME**	**G/UG**	**MD**	**ELB/LB/ RB**	**L4**
Transport Canada Specifications	3AAM-153	3AAM-153	3AAM-153	3AAM-153	–	3AAM-153
DOT Specifications	3AA-2015	3AA-2015	3AA-2015	3AA-2015	3E-1800	3AA-2015
Internal Volume						
ft^3	0.52	0.17	0.25	0.10	0.015	0.075
L	14.72	4.81	7.08	2.83	0.42	2.12
Water Capacity						
lb	32.46	10.61	15.61	6.24	0.94	4.68
kg	14.73	4.81	7.08	2.83	0.42	2.12
Nominal Dimensions						
Diameter (in)	7.00	4.00	6.00	4.04	2.00	4.18
Diameter (cm)	17.78	10.16	15.24	10.26	5.08	10.62
Height (in)	31.00	25.75	20.00	16.75	16.00	14.00
Height (cm)	78.74	65.40	50.80	42.55	40.64	35.56
Average Tare Weight						
lb	65	13	29	9	4	9
kg	29.48	5.90	13.15	4.08	1.81	4.08

Note: Dimensions and capacities are approximate and may vary slightly.



	High-Pressure Aluminum				
Part Number Code	**AT**	**AS**	**AQ**	**AG**	**A3/AH**
Transport Canada Specifications	3ALM-153	3ALM-139	3ALM-153	3ALM-153	3ALM-153
DOT Specifications	3AL-2216	3AL-2015	3AL-2216	3AL-2216	3AL-2216
Internal Volume					
ft^3	1.700	1.050	0.556	0.140	0.208
L	48.1	29.7	15.7	3.96	5.9
Water Capacity					
lb	106.1	65.4	34.6	8.7	12.98
kg	48.1	29.7	15.7	3.96	5.9
Nominal Dimensions					
Diameter (in)	9.8	8.00	7.25	5.25	6.9
Diameter (cm)	24.9	20.3	18.4	13.34	17.5
Height (in)	51.9	48.0	32.9	17.1	15.6
Height (cm)	131.9	121.9	83.5	43.5	39.7
Average Tare Weight					
lb	90	48	30.7	8.8	14.6
kg	40.8	21.87	13.9	4.0	6.6

Note: Dimensions and capacities are approximate and may vary slightly.



Compressed Gas Cylinders

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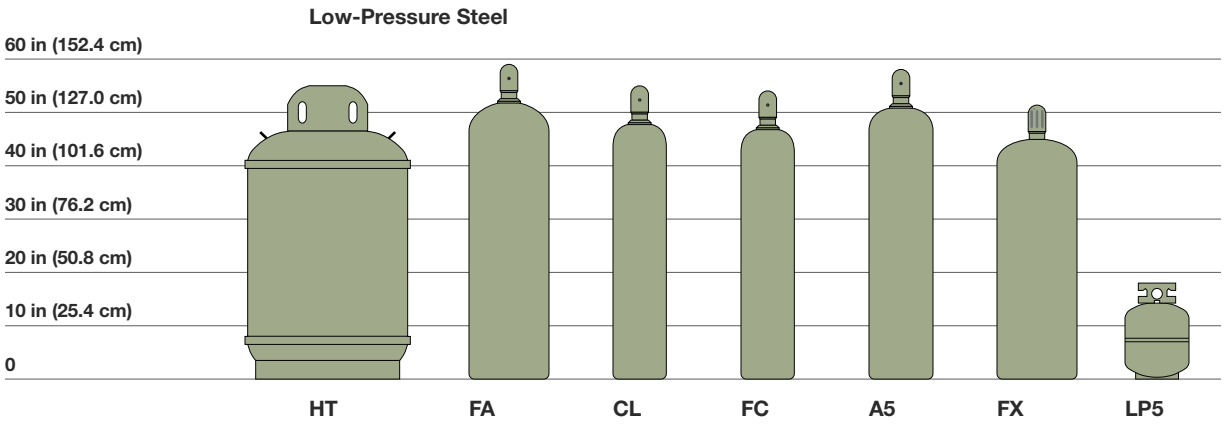
	Low-Pressure Steel						
Part Number Code	**HT**	**FA**	**CL**	**FC**	**A5**	**FX**	**LP5**
DOT Specifications	4BWM-240	4AA-480	3A-480	4BA-300	8AL	4BA-240	4BA-240
Internal Volume							
ft^3	16.05	4.46	1.93	1.97	–	3.83	0.78
L	454.5	126.3	54.6	55.8	–	108.5	21.59
Water Capacity							
lb	1002.0	278.4	120.5	123.0	–	239.1	47.60
kg	454.5	126.3	54.6	55.8	–	108.5	8.18
Nominal Dimensions							
Diameter (in)	29.75	15.0	10.0	10.0	12.00	15.0	12.00
Diameter (cm)	75.6	38.1	25.4	25.4	30.00	38.1	30.48
Height (in)	55.0	52.0	48.0	47.0	51.00	45.0	17.66
Height (cm)	140.0	132.0	122.0	119.0	130.00	114.0	44.85
Average Tare Weight							
lb	315	151	85	55	189.00	75	18.00
kg	143	69	39	25	85.73	34	8.18

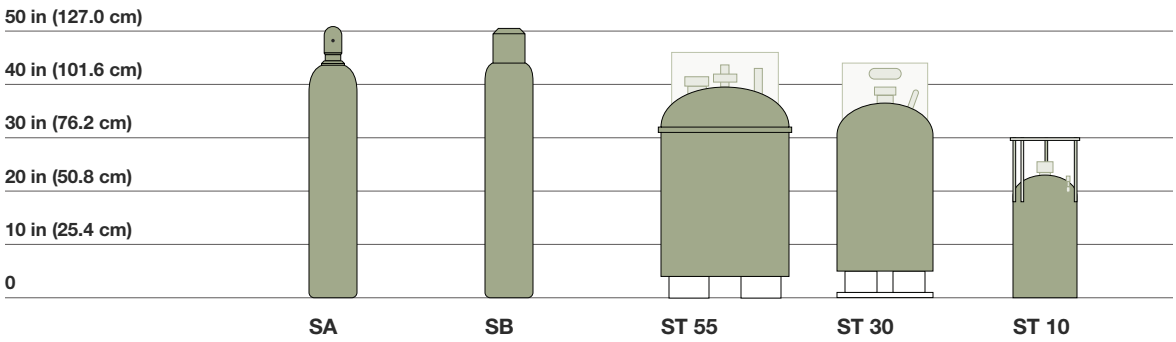
Note: Dimensions and capacities are approximate and may vary slightly.



	Low-Pressure Drums, Low-Pressure Stainless Steel Drums and Cylinders				
Part Number Code	**SA**	**SB**	**ST 55**	**ST 30**	**ST 10**
DOT Specifications	E-4884-240	E-4884-240	UN-1A1	UN-1A1	UN-1A1
Internal Volume					
ft^3	1.450	1.450	7.35	4.01	1.340
L	41.1	41.1	208.0	114.0	37.9
Water Capacity					
lb	90.5	90.52	458.9	250.3	83.7
kg	41.1	41.1	208.0	114.0	37.9
Nominal Dimensions					
Diameter (in)	9.0	9.0	24.0	18.0	12.0
Diameter (cm)	22.9	22.9	61.0	45.7	30.5
Height (in)	44.0	44.0	46.0	44.0	30.0
Height (cm)	112.0	112.0	117.0	112.0	76.2
Average Tare Weight					
lb	36	36	250	150	50
kg	16.3	18.1	113	68	22.7

Note: Dimensions and capacities are approximate and may vary slightly.

Low-Pressure Drums, Low-Pressure Stainless Steel Drums and Cylinders



Liquid Helium Containers

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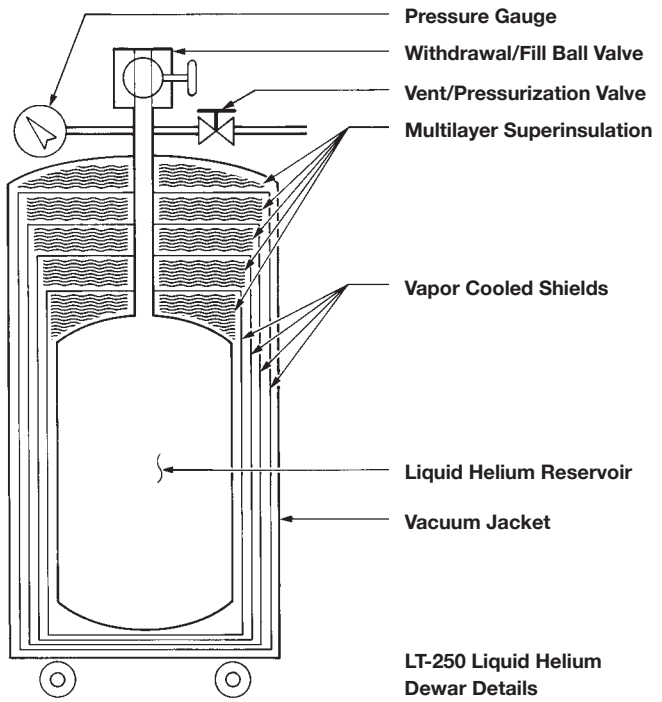
High Performance Liquid Helium Dewars

Praxair dewars make handling liquid helium easier because they have several features developed and patented specifically for this special purpose.

- Multi-layer insulation to reduce evaporation losses.
- Cooled shields to simplify your operation and help reduce costs. Escaping helium vapor is used to cool the system, avoiding the need for cooling with nitrogen and the subsequent cost and potentially harmful release in an enclosed area.
- Light weight for easier lifting and moving.
- Rugged, all-welded construction for increased performance life of the multi-layer insulation and shield system.
- Large-diameter neck tubes to allow for better structural integrity and for larger-sized liquid helium withdrawal apparatus.
- Non-magnetic dewars available for use with Magnetic Resonance Imaging (MRI) units.
- Absolute relief valve to extend use of dewars to airborne as well as surface shipments.
- Complete Society of Automotive Engineers (SAE) range of dewars available to meet all known liquid helium volume needs.

LT-100 *LT-250* *LT-500*

	LT-60	LT-100	LT-250	LT-500
Capacity (liters max)	60	100	250	500
Diameter (in/cm)	24/61	24/61	32/81.3	42/106.7
Height (in/cm)	51/127.3	59/147.9	67/171.1	70/179.3
Tare Weight (lb/kg)	165/75	200/91	335/152	540/245
Neck Diameter (in/cm)	1.45/3.7	1.45/3.7	2.4/6.1	2.9/7.4
NER (Static loss max. per day)	1.75%	1.25%	1%	.75%



LT-250 Liquid Helium Dewar Details

Cryogenic Containers

	Cryogenic Containers			
Part Number Code	**LC 160**	**LC 180**	**LC 200**	**LC 230**
DOT Specifications	4L200	4L200	4L412	4L200
Pressure (Psi)	22/230/350	22/230/350	22/230/350	22/230/350
Internal Volume				
ft^3	6.21	6.77	7.21	8.47
L	175.85	191.71	204.16	239.84
Water Capacity				
lb	387.69	422.65	469.20	528.78
kg	175.85	191.71	212.83	239.85
Nominal Dimensions				
Diameter (in)	20.00	20.00	20.00	26.00
Diameter (cm)	50.80	50.80	50.80	66.04
Height (in)	60.00	64.00	65.80	53.00
Height (cm)	152.40	162.56	167.13	134.62
Average Tare Weight				
lb	250	260	375	300
kg	113.40	117.93	170.10	136.08

Note: Dimensions and capacities are approximate and may vary slightly.

LC 230 *LC 180* *LC 200* *LC 160*

Praxair's Microbulk Gas Delivery System

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Praxair's Microbulk on-site gas delivery system is a cost-effective cylinder alternative for your business. By replacing cylinders with an on-site supply, Praxair's Microbulk delivery system helps you maximize profitability and improve efficiency.

Convenience

- Praxair supply management – telemetry
- No cylinder handling and changeouts
- Reduced inventory management

Increased Productivity and Savings

- Eliminates downtime from cylinder changeouts
- More efficient accounting and ordering
- Minimum inventory maintenance
- Productive use of labor force
- Efficient use of production space
- Lower maintenance costs

High Quality

- Consistent high purity
- Higher product yield

Improved Safety

- Eliminates cylinder handling
- No worries about cylinder leaks
- High-pressure cylinders replaced by low-pressure tanks

A variety of CO_2 storage tanks are available to meet your specific needs.

Small-volume, mobile Microbulk tanks.

Liquid argon and nitrogen improve productivity in many industrial applications.

Praxair's Microbulk Gas Delivery System

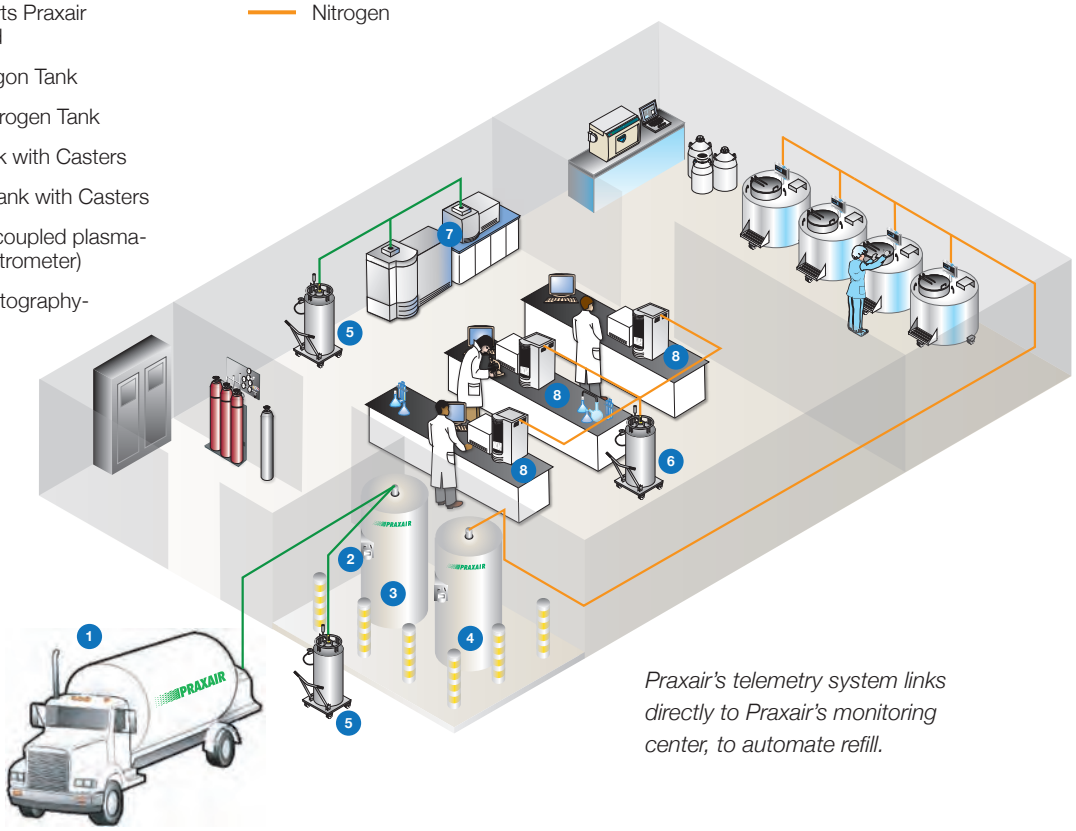
Your alternative gas delivery system

Praxair's Microbulk gas delivery system offers scalable, mobile solutions for your lab's gas needs, allowing you to move supply throughout your lab where and when you need them most.

As North America's largest industrial gases company, Praxair has leveraged our size and experience to bring you a dependable gas delivery system to meet your specific needs.

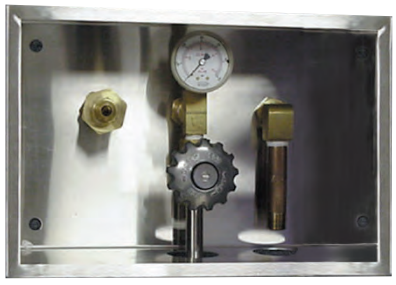
1. Praxair MicroBulk Truck
2. Telemetry System alerts Praxair when a refill is needed
3. Exterior Stationary Argon Tank
4. Exterior Stationary Nitrogen Tank
5. Perma-Cyl Argon Tank with Casters
6. Perma-Cyl Nitrogen Tank with Casters
7. ICP-AES (inductively coupled plasma-atomic emission spectrometer)
8. LC-MS (liquid chromatography-mass spectrometer)

— Argon
— Nitrogen



Praxair's telemetry system links directly to Praxair's monitoring center, to automate refill.

Praxair's truck fleet, designed exclusively for cryogenic gases services, delivers from diverse distribution locations for maximum customer efficiency.



A locked, tamper-resistant fill box is wall-mounted outside to let Praxair deliver the gas you need around the clock.

Praxair's Microbulk Gas Delivery System

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Nitrogen, Oxygen and Argon

	450 Liter			1000 Liter			1500 Liter		2000 Liter	
Model	**450MP**	**450HP**	**450VHP**	**1000MP**	**1000HP**	**1000VHP**	**1500HP**	**1500VHP**	**2000HP**	**2000VHP**
Capacity										
Gross Capacity (liters)	450	450	450	1056	1056	1056	1550	1550	2042	2042
Net Capacity (liters)	420	420	420	950	950	950	1455	1455	1945	1945
MAWP										
psig	250	350	500	250	350	500	350	500	350	500
(bar)	(17.2)	(24.1)	(34.5)	(17.2)	(24.1)	(34.5)	(24.1)	(34.5)	(24.1)	(34.45)
Storage Capacity										
Nitrogen (scf)	10332	10332	10332	23370	23370	23370	35550	35550	47847	47847
Nitrogen (Nm^3)	272	272	272	615	615	615	935	935	1257	1257
Oxygen (scf)	12760	12760	12760	28861	28861	28861	43900	43900	59089	59089
Oxygen (Nm^3)	336	336	336	759	759	759	1155	1155	1553	1553
Argon (scf)	12478	12478	12478	28225	28225	28225	42950	42950	57786	57786
Argon (Nm^3)	328	328	328	742	742	742	1130	1130	1519	1519
Thermal Performance (NER/Day)										
Nitrogen	1.80%	1.80%	1.80%	1%	1%	1%	1%	1%	1%	1%
Oxygen – Argon	1.12%	1.12%	1.12%	0.62%	0.62%	0.62%	0.62%	0.62%	0.62%	0.62%
Gas Delivery Rate										
scf/h	575	575	575	960	960	960	1350	1350	1350	2000
(m^3/h)	(15.1)	(15.1)	(15.1)	(25.2)	(25.2)	(25.2)	(35.4)	(35.4)	(35.4)	(52.4)
Diameter										
in (cm)	30 (76)	30 (76)	30 (76)	42 (107)	42 (107)	42 (107)	48 (122)	48 (122)	48 (122)	48 (122)
Height										
in (cm)	68 (173)	68 (173)	68 (173)	77 (196)	77 (196)	77 (196)	91 (231)	91 (231)	117 (297)	117 (297)
Tare Weight										
lb	605	688	812	1550	1750	2080	2692	3200	3860	3860
(kg)	(274)	(312)	(368)	(703)	(794)	(945)	(1221)	(1451)	(1751)	(1751)
Design Specification	ASME	ASME	ASME	ASME	ASME	ASME	ASME	ASME	ASME	ASME

Carbon Dioxide

Model	**160 lb**	**300 lb**	**400 lb**	**600 lb**
Liquid Storage Capacity (lb)	160	300	400	600
Gross Capacity (liters)	71	128	175	275
MAWP psig (bar)	300 (21)	300 (21)	300 (21)	300 (21)
Operating Pressure psig (bar)	125 (8.6)	125 (8.6)	125 (8.6)	125 (8.6)
Evaporation Rate (lb/day)	1.2	2.0	2.5	3.5
CO_2 Delivery Rate (lb/h)	0.75	1.0	5.5	15.0
Diameter in (cm)	20 (51)	20 (51)	20 (51)	24 (61)
Height in (cm)	31 (79)	47 (119)	68 (173)	68 (173)
Empty Weight lb (kg)	145 (66)	200 (91)	305 (139)	375 (170)
Design Specification	ASME	ASME	ASME	ASME

Normal Boiling Point

Liquid Argon	-302 °F (-185 °C)
Liquid Nitrogen	-320 °F (-196 °C)
Liquid Oxygen	-297 °F (-183 °C)

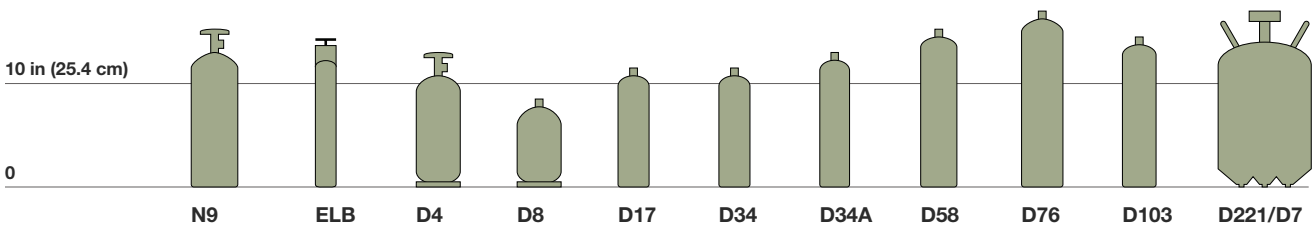
Sublimation Point

Liquid CO_2	-109.3 °F (-78.5 °C)

Portables

	Refillable	Non-Refillable									
Part Number Code	**N9**	**ELB**	**D4**	**D8**	**D17**	**D34**	**D34A**	**D58**	**D76**	**D103**	**D221/D7**
Transport Canada Specifications	TC 3ALM-139	TC 3EMI2Y	TC 39M NRC	SU 5140	TC 39M NRC	TC 39M NRC	TC 39M NRC	TC 39M NRC	TC 39M NRC	TC 39M NRC	TC 39M NRC
DOT Specifications	3AL-2015	3E1800	DOT-39	E-8990	39 NRC	39 NRC	39 NRC	39 NRC	39 NRC	39 NRC	39 NRC
Pressure											
psig	2000	2200	2200	2200	240	500	500	500	500	1000	260
bar	138	152	152	152	16.5	24.5	24.5	34.5	34.5	68.9	7.9
Nominal Contents											
Cu. Ft.	8.75	–	–	–	0.6	1.2	1.2	2.0	2.6	3.6	7.9
Liters	248	–	–	–	17	34	34	58	76	103	221
Nominal Dimensions											
Diameter (in)	4.40	2.00	4.25	4.25	3.00	3.00	2.88	3.50	4.00	3.25	9.00
Diameter (cm)	11.18	5.08	10.80	10.80	7.62	7.62	7.30	8.89	10.16	8.26	22.86
Height (in)	17.84	14.25	13.00	7.75	10.75	10.75	11.50	14.50	16.25	13.67	16.50
Height (cm)	45.31	36.20	33.02	19.69	27.30	27.30	29.20	36.83	41.28	34.74	41.91
Average Tare Weight											
lb	6.32	4.00	8.00	5.00	1.10	1.40	0.80	1.60	1.75	2.3	6.30
kg	2.87	1.81	3.63	2.27	0.50	0.63	0.36	0.73	0.79	1.04	2.86
Outlet Connection	CGA	CGA 580	CGA 580	CGA 580	CGA 600	CGA 600	C-10 5/8" -18UNF	C-10 5/8" -18UNF	CGA 170	C-10 5/8" -18UNF	CGA 165

Portables



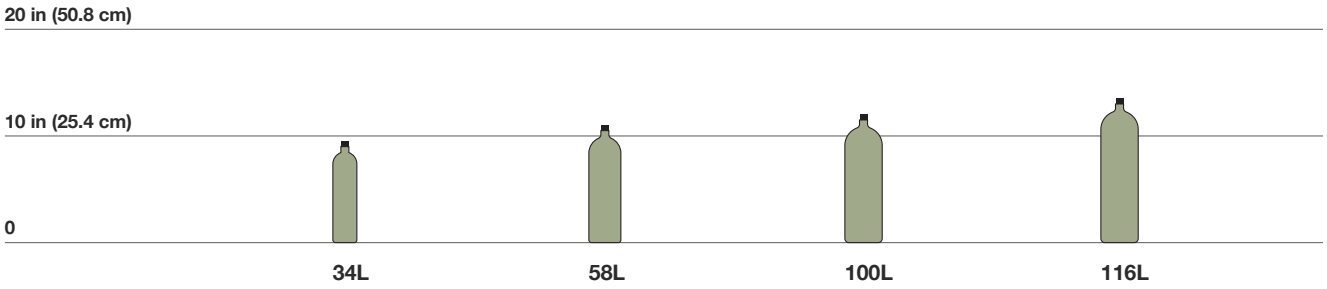
Portables

PortaGreen™ Recyclable Portable Cylinders

PRAXAIR
Making our planet more productive

Cylinder	34 Gal	58 Gal	100 Gal	116 Gal
Gas Contents	34 liters	58 liters	100 liters	116 liters
Pressure	985 psi	1000 psi	1000 psi	1000 psi
Connection	C-10 5/8" – 18 UNF	C-10 5/8" – 18 UNF	C-10 5/8" – 18 UNF	C-10 5/8" – 18 UNF
Material of Construction	Aluminum	Aluminum	Aluminum	Aluminum
Weight	.99 lb	1.43 lb	2.4 lb	3.74 lb
Dimensions	2.5" x 9.5"	2.9" x 10.8"	3.5" x 12"	3.5" x 13.5"
Cylinder Compliance	ISO7866	ISO7866	ISO7866	ISO7866
Regulator	Series 100	Series 100	Series 100	Series 100

***PortaGreen* Recyclable Portables**



Section

B

In this section

- Over 50 Pure Gases in more than 170 grades to meet your needs
- The right grades developed for the right applications
- Cylinder, transport and MSDS Information for each Pure Gas
- Equipment recommendations
- Cyrogenic pure gases in a broad selection of containers, including dewars, microbulk, and bulk tanks
- Tube trailers for your large volume gas needs
- Pure product quality assay shown is guaranteed minimum purity specification. For each product grade, “less than values” for typical impurities are provided. Upon request, additional impurity identification, analysis or certification can be provided.
- Additional cylinder styles may be available upon request.

Note:
Some specifications may vary in different geographical locations and are subject to change without notice.

Acetylene C_2H_2

Transportation Information			
UN Number: 1001			
Shipping Name	Acetylene, Dissolved	Acetylene, Dissolved	Acetylene, Dissolved
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4559

(M)SDS Reference for DMF Solvent
P-6201

CAS Number
74 - 86 - 2

General Description
Colorless, highly flammable gas.

Name	Grade	Part Number	Cylinder	$O_2 + CH_4$	PH_3	N_2	O_2 + Ar	CO	CO_2	CH_4	C_2H_6	C_3H_8
Atomic Absorption	99.6%	AC 2.6AA	A5	4000 ppm	20 ppm	–	–	–	–	–	–	–
Semiconductor	99.95%	AC 3.5AHM(1)	A420	–	–	300	100	20	20	20	20	20

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

(1) DMF Solvent

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft^3 (m^3)	Gross Weight lb (kg)
A5	Low Pressure Steel	51 x 12 (130 x 30)	510	250 (17.24)	360 (10.19)	207 (94)
A420	Low Pressure Steel	51 x 12 (130 x 30)	510	250 (17.24)	420 (11.89)	207 (94)

Equipment Recommendations

2002 Series – High Purity Economical Regulator
(see page E•257)

See Section D for Praxair's complete line of instrument support gases and mixtures (pages D•214 - D•218).

See Sections F and G for safety and technical information.

Transportation Information			
UN Number: 1002			
Shipping Name	Air, Compressed	Air, Compressed	Air, Compressed
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4560

CAS Number
132259 - 10 - 0

General Description
Colorless, odorless, nonflammable gas.

Name	Part Number	Cylinder	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	0.3	0.05	0.01 VOC(1)	–	–	–
Vehicle Emission Zero (1065)	AI 0.0VE1065	AS, AQ, A3 T, K	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	AS, AQ, T, K	18 - 21% abs	1	1	0.5	0.1	0.1	–	–
BAR-97 Zero Air	MS BAR97ZA	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%	3	–	–	1	–	–	–
Extra Dry	AI 0.0XD	T, K	19.5 - 23.5%	10	–	–	–	–	–	–

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

(1) Can be individually analyzed for customer selected VOC components.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft^3 (m^3)	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	590	2640 (183)	310 (8.60)	165 (76)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	590	2200 (154)	232 (6.43)	150 (68)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	590	2200 (154)	78 (2.16)	71 (32)
AS	High Pressure Aluminum	48 x 8 (121.9 x 20.3)	590	2000 (139)	144 (3.99)	62 (28)
AQ	High Pressure Aluminum	33 x 7.3 (83.8 x 18.4)	590	2200 (154)	83.2 (2.30)	47 (21)
A3	High Pressure Aluminum	16 x 6.9 (40.6 x 17.5)	590	2200 (154)	31.0 (0.86)	17 (8)
D7	Portable	16.5 x 9 (41.9 x 22.9)	165	260 (17.9)	7.8 (0.21)	7 (3)

Cylinder packs and tube trailers are available upon request

Contact your Praxair representative about equipment recommendations for air.

Ammonia NH_3

Transportation Information **UN Number:** 1005			
Shipping Name	Ammonia, Anhydrous	Ammonia, Anhydrous, Liquified	Ammonia, Anhydrous
Hazard Class	2.2	2.3 (8)	2.2
Label	Nonflammable Gas, Inhalation Hazard	Poison Gas, Gas	Nonflammable Gas

(M)SDS Reference
P-4562

CAS Number
7664 - 41 - 7

General Description
Colorless, toxic, corrosive, liquefied gas with a sharp, intensely irritating odor.

Product Grade	Purity	Part Number	Cylinder	O_2 + Ar	N_2	H_2O	CO_2	CO	H_2	CH_4	Metals
Semiconductor, 6.5	99.99995%	AM 6.5SP	K, AS	50 ppb	–	200 ppb	100 ppb	50 ppb	100 ppb	50 ppb	See Below(1)
Semiconductor, 5.5	99.9995%	AM 5.5SP	K, AS	0.5	1	1	–	0.1	–	0.5	–
Research, 5.0	99.999%	AM 5.0RS	K, AS, Q, G	2	3	2	–	0.5	–	3	–
Anhydrous, 4.5	99.995%	AM 4.5	K, FA, Q, G	–	–	–	–	–	–	–	–

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

(1) Metals – Sb, Ca, Cd, Cr, Cu, Ga, Ge, Au, Fe, Pb, Li, Mg, Mn, Mo, Ni, K, Si, Na, Sn. All < 10 ppb/w each.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
FA	Low Pressure Steel	52 x 15 (132.1 x 38.1)	240	114 (7.86)	150 (68.0)	300 (136)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	240, 705/720	114 (7.86)	50 (22.7)	183 (83)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	240, 705/720	114 (7.86)	15 (6.8)	80 (36)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	240, 705/720	114 (7.86)	8 (3.63)	40 (18)
AS	High Pressure Aluminum	48 x 8 (121.9 x 20.3)	705/720	114 (7.86)	30 (13.6)	80 (36)

Equipment Recommendations

Semiconductor, 6.5	Valve panels, gas cabinets
Semiconductor, 5.5	Valve panels, gas cabinets
Research, 5.0	Valve panels, gas cabinets, 4000 series corrosive regulator
Anhydrous, 4.5	Valve panels, gas cabinets, 4000 series corrosive regulator, 4008 series regulator

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

Argon

Ar

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Transportation Information			
UN Number: 1006			
Shipping Name	Argon, Compressed	Argon, Compressed	Argon, Compressed
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4563

CAS Number
7440 - 37 - 1

General Description
Colorless, odorless, nonflammable inert gas.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2	CO	H_2	THC
Semiconductor, 6.0	99.9999%	AR 6.0SP	AT, AS	0.5	0.2	0.2	0.1	0.1	0.1	0.1
Research, 6.0	99.9999%	AR 6.0RS	K, T	1	0.2	1	0.1	0.1	–	0.1
Chromatography, 6.0	99.9999%	AR 6.0CH	K, T	1	0.2	1	0.1	0.1	–	0.1
Trace Analytical, 5.5	99.9995%	AR 5.5TG	K, T, AT	2	0.5	0.5	0.1	0.1	–	0.5
Semiconductor, 5.5	99.9995%	AR 5.5SP	AT	2	0.5	0.5	0.5	0.5	0.5	0.5
Carrier, 5.5	99.9995%	AR 5.5CA	T, K	5	0.5	0.5	1	1	–	0.3
UHP Plus, 5.3	99.9993%	AR 5.3UP	T, K	–	1	1	1	1	–	0.5
Ultra High Purity, 5.0	99.999%	AR 5.0UH	T, K	–	2	3	–	–	–	0.5
Semiconductor, 5.0	99.999%	AR 5.0SP	K, AS	6	2	3	1	1	–	1
High Purity, 4.8	99.998%	AR 4.8	6K, 4K, 3K, T, K	–	4	3	–	–	–	–
Zero, 4.8	99.998%	AR 4.8Z	T, K, Q	–	4	3	–	–	–	0.5

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume ft^3 (m^3)	Gross Weight lb (kg)
6K	Ultra High Pressure Steel	51 x 10 (129.5 x 24.4)	677	6000 (460)	575 (15.94)	362 (164)
4K	Ultra High Pressure Steel	51 x 9.3 (129.5 x 23.5)	680	4500 (310)	495 (13.23)	198 (90)
3K	Ultra High Pressure Steel	51 x 10 (129.5 x 24.4)	680	3500 (268)	385 (10.68)	228 (103)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	580/718	2640 (183)	335 (9.29)	177 (80)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	580/718	2200 (154)	248 (6.88)	158 (72)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	580	2200 (154)	83 (2.30)	74 (34)
AT	High Pressure Aluminum	54 x 10 (137.2 x 25.4)	580/718	2200 (154)	272 (7.54)	120 (54)
AS	High Pressure Aluminum	48 x 8 (121.9 x 20.3)	580/718	2000 (139)	153 (4.24)	66 (30)
230/240	Portable Liquid Unit	53 x 26 (134.6 x 66.0)	580	22-350	various	various
MB	Microbulk	Various – see page A•18	580	various	various	various
	Cylinder packs and tube trailers are available upon request					

Contact your Praxair representative about equipment recommendations for Argon.

Boron Trichloride BCl_3

Transportation Information **UN Number:** 1741			
Shipping Name	Boron Trichloride	Boron Trichloride	Boron Trichloride
Hazard Class	2.3 (8)	2.3 (8)	2.3
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4566

CAS Number
10294 - 34 - 5

General Description
Colorless, toxic, corrosive, nonflammable, liquefied gas with a pungent choking odor.

Product/ Grade	Purity	Part Number	Cylinder	O_2	CO	N_2	CH_4	CO_2	Silicon	$COCl_2$ (phosgene)	Cl_2	HCL
Semiconductor, 5.0	99.999%	BC 5.0SP	K, G	3	0.5	10	0.2	0.2	1 ppm/w	1	1	5
Semiconductor, 3.6	99.96%	BC 3.6SP	K, G	–	–	–	–	–	10 ppm/w	300	100	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660/634	4.4 (0.30)	100 (45.36)	223 (101)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	660/634	4.4 (0.30)	14 (6.35)	43 (20)

Equipment Recommendations

Semiconductor, 5.0	Gas cabinets
Semiconductor, 3.6	Gas cabinets

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

See our complete line of gas delivery systems in Section E, including gas cabinets, process panels, and controllers.

Isotopically Enriched BF_3

$B^{11}F_3$

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Transportation Information			
UN Number: 1008			
Shipping Name	Boron Trifluoride	Boron Trifluoride	Boron Trifluoride
Hazard Class	2.3 (8)	2.3 (8)	2.3 (8)
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4820-C

CAS Number
20654 - 88 - 0

General Description
Colorless, toxic, corrosive, nonflammable gas with a pungent odor.

Product/Grade	Purity	Cylinder	Isotopic Enrichment	N_2	Ar	O_2	CO_2	HF	SO_2
Semiconductor, 3.0	99.9%	L4, ELB, *UpTime*®	99.7%	25	25	25	25	25	25

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume gr (kg)	Gross Weight lb (kg)
L4	High Pressure Steel	14 x 4.2 (35.5 x 10.6)	330/642	675 (46.5)	400 (0.4)	11 (5)
ELB	High Pressure Steel	16 x 2 (40.6 x 5)	330/642	700 (48.3)	80	6 (3)
UpTime	Sub-Atmospheric	See page D•146 for all sub-atmospheric ion implant packaging.				

Equipment Recommendations

UpTime Sub-Atmospheric packaging (see page D•146)

See Section D for additional information on Praxair's Semiconductor product line (pages D·143 - D·148).

See our complete line of gas delivery systems in Section E, including gas cabinets, process panels, and controllers.

Boron Trifluoride BF_3

Transportation Information			
UN Number: 1008			
Shipping Name	Boron Trifluoride	Boron Trifluoride	Boron Trifluoride
Hazard Class	2.3 (8)	2.3 (8)	2.3 (8)
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4567

CAS Number
7637 - 07 - 2

General Description
Colorless, toxic, corrosive, nonflammable gas with a pungent odor.

Product/Grade	Purity	Part Number	Cylinder	Air	SO_2	SiF_4
Semiconductor, 2.5	99.5%	BF 2.5SP	L4, ELB	4000 ppm/w	20 ppm/w	300 ppm/w

Maximum ppm unless otherwise noted.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume grams	Gross Weight lb (kg)
L4	High Pressure Steel	14 x 4.2 (35.5 x 10.6)	330/642	675 (46.5)	400	11 (5)
ELB	High Pressure Steel	16 x 2 (40.6 x 5)	330/642	700 (48.3)	80	6 (3)

Equipment Recommendations

SurePurge™ 1500 – Two Cylinder Cabinet (see page E•306)

See Section D for additional information on Praxair's Semiconductor product line (pages D·143 - D·148).

See our complete line of gas delivery systems in Section E, including gas cabinets, process panels, and controllers.

1,3 Butadiene

C_4H_6

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Transportation Information			
UN Number: 1010			
Shipping Name	Butadienes, Stabilized	Butadienes, Stabilized	Butadienes, Stabilized
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4571

CAS Number
106 - 99 - 0

General Description
Colorless, flammable, liquefied gas with a mildly aromatic odor.

Product/Grade	Purity	Part Number	Cylinder	H_2O	Butadiene Dimer	Butenes	Sulfur
Chemically Pure (CP), 2.0	99.0 wt% (liquid phase)	BD 2.0	FX/FXS,(1) LP5	–	–	–	–

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

(1) FXS cylinders include eductor tube.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lbs (kgs)	Gross Weight lb (kg)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510, 555	21.4 (1.48)	129 (58.5)	203 (92)
LP5	Low Pressure Steel	17.7 x 12 (44.8 x 30.5)	510	21.4 (1.48)	25 (11.36)	45 (20.45)

Equipment Recommendations

2002 Series – High Purity Economical Regulator
(see page E•257)

See Section D for additional information on Praxair products for the Hydrocabon Processing Industry (pages D•175 - D•184).

Due to extreme reactivity and tendency to polymerize, 1,3- Butadiene is shipped with an inhibitor.

n-Butane

C_4H_{10}

Transportation Information

UN Number: 1011

Shipping Name	Butane	Butane	Butane
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4572

CAS Number
106 - 97 - 8

General Description
Colorless, flammable, liquefied gas.

Product/Grade	Purity	Part Number	Cylinder	O_2	N_2	H_2O	THC	Sulfur
Research, 4.0	99.99 wt% (liquid phase)	BU 4.0RS	FX/FXS,(1) LP5	5	20	3	90 ppm/wt	1 ppm/wt
Instrument, 2.5	99.5% wt% (liquid phase)	BU 2.5IS	HT, FX/FXS,(1) LP5	–	–	5	0.45 wt%	1 ppm/wt
Chemically Pure (CP), 2.0	99.0% wt% (liquid phase)	BU 2.0	HT, FX/FXS,(1) LP5	–	–	10	0.9 wt%	2 ppm/wt

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

(1) FXS cylinders include eductor tube.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	510	16.3 (1.12)	500 (227.27)	815 (370.45)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510, 555	16.3 (1.12)	120 (54.4)	215 (98)
LP5	Low Pressure Steel	17.7 x 12 (44.8 x 30.5)	510	16.3 (1.12)	24 (10.9)	42 (19)

Equipment Recommendations

Research, 4.0	4000 series non-corrosive regulator
Instrument, 2.5	3000 series non-corrosive regulator
Chemically Pure (CP), 2.0	2000 series non-corrosive regulator

2002 Series – High Purity Economical Regulator
(see page E•257)

See Section D for additional information on Praxair products for the Hydrocabon Processing Industry (pages D•175 - D•184).

See Sections F and G for safety and technical information.

1-Butene

C_4H_8

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Transportation Information			
UN Number: 1012			
Shipping Name	Butylene	Butylene	Butylene
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-6214

CAS Number
106 - 98 - 9

General Description
Colorless, flammable, liquefied gas with a slightly aromatic odor.

Product/ Grade	Purity	Part Number	Cylinder	H_2O	THC	Sulfur
Chemically Pure (CP), 2.0	99.0 wt% (liquid phase)	BT 2.0	FX/FXS,(1) LP5	10	0.9 wt%	2 wt

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

(1) FXS cylinders include eductor tube.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510, 555	23.5 (1.62)	128 (58.1)	225 (102)
LP5	Low Pressure Steel	17.7 x 12 (44.8 x 30.5)	510	23.5 (1.62)	25 (11.34)	43 (19.5)

Equipment Recommendations

2002 Series – High Purity Economical Regulator
(see page E•257)

See Section D for additional information on Praxair products for the Hydrocabon Processing Industry (pages D•175 - D•184).

See Sections F and G for safety and technical information.

cis - 2 - Butene

C_4H_8

Transportation Information			
UN Number: 1075			
Shipping Name	Petroleum Gases, Liquefied	Petroleum Gases, Liquefied	Petroleum Gases, Liquified
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4577

CAS Number
590 - 18 - 1

General Description
Colorless, flammable, liquefied gas with a slightly aromatic odor.

Product/ Grade	Purity	Part Number	Cylinder	Trans-2-butene
Chemically Pure (CP), 2.0	99.0%	CB 2.0	LP5	0.7 wt%

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
LP5	Low Pressure Steel	17.7 x 12 (44.8 x 30.5)	510	13 (90)	20 (9)	40 (18.2)

Equipment Recommendations

2002 Series – High Purity Economical Regulator
(see page E•257)

See Section D for additional information on Praxair products for the Hydrocabon Processing Industry (pages D•175 - D•184).

See Sections F and G for safety and technical information.

Praxair, your source for technical support.

Trans - 2 - Butene

C_4H_8

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Transportation Information			
UN Number: 1075			
Shipping Name	Petroleum Gases, Liquefied	Petroleum Gases, Liquefied	Petroleum Gases, Liquified
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4578

CAS Number
624 - 64 - 6

General Description
Colorless, flammable, liquefied gas with a slightly aromatic odor.

Product/Grade	Purity	Part Number	Cylinder	n-Butene	1-Butene	Cis-2-Butene
Chemically Pure (CP), 2.0	99.0%	TB 2.0	LP5	0.5 wt%	0.2 wt%	0.2 wt%

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lbs (kg)	Gross Weight lb (kg)
LP5	Low Pressure Steel	17.7 x 12 (44.8 x 30.5)	510	15 (103)	20 (9)	40 (18.2)

Equipment Recommendations

2002 Series – High Purity Economical Regulator (see page E•257)

See Section D for additional information on Praxair products for the Hydrocabon Processing Industry (pages D•175 - D•184).

See Sections F and G for safety and technical information.

Praxair's extensive distribution network ensures on-time delivery.

Carbon Dioxide CO_2

Transportation Information

UN Number: 1013

			
Shipping Name	Carbon Dioxide	Carbon Dioxide	Carbon Dioxide
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4574

CAS Number
124 - 38 - 9

General Description
Colorless, odorless, nonflammable, slightly acidic, liquefied gas.

Product/Grade	Purity Number	Part	Cylinder	O_2	N_2	H_2O	CO	Halocarbons[1] (as CCl_4)	THC (as CH_4)	THC (C_7-C_{26})[2] (as Dodecane)	H_2
Laser Star, 5.5	99.9995%	CD 5.5LS	AT	5	–	0.5	–	100 ppt	0.1	10 ppb	–
Laser Star, 5.0	99.999%	CD 5.0LS	K	5	–	3	–	–	1	–	–
Supercritical Fluid Extraction (SFE), 5.0	99.999%	CD 5.0SE	AS	2	5	0.5	0.1	100 ppb	2	10 ppb	0.1
Semiconductor, 4.8	99.998%	CD 4.8SP	K, AT	2	10	3	0.5	–	4	–	0.5
Supercritical Fluid Chromatography (SFC), 4.8	99.998%	CD 4.8SC	AS	5	10	1	0.1	–	2	50 ppb	0.1
Research, 4.8	99.998%	CD 4.8RS	K, AS	2	10	3	0.5	–	4	–	–
Laser Star, 4.5	99.995%	CD 4.5LS	K	5	–	5	–	–	1	–	–
Semiconductor, 4.0	99.99%	CD 4.0SP	K AT	10	50	10	–	–	5	–	–
Anaerobic, 4.0	99.99%	CD 4.0AN	K, Q	10	–		–	–	–	–	–
Instrument (Coleman), 4.0	99.99%	CD 4.0IS	K, Q	15	–	10	–	–	–	–	–
Bone Dry, 3.0	99.9%	CD 3.0	K, Q	–	–	10	–	–	–	–	–

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

(1) Total extractable halocarbons
(2) Total extractable hydrocarbons

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	320/716	830 (57.2)	60 (27.2)	193 (88)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	320	830 (57.2)	20 (9.1)	86 (8)
AT	Aluminum High Pressure	54 x 10 (137.2 x 25.4)	320/716	830 (57.2)	70 (31.75)	156 (71)
AS	Aluminum High Pressure	48 x 8 (121.9 x 20.3)	320/716	830 (57.2)	39 (17.7)	89 (40)

Equipment Recommendations

Laser Star, 5.5	4000 series non-corrosive regulator
Laser Star, 5.0	4000 series non-corrosive regulator
Supercritical Fluid Extraction (SFE), 5.0	SFE/SFC Kit
Semiconductor, 4.8	Valve panels
Supercritical Fluid Chromatography (SFC), 4.8	SFE/SFC Kit
Research, 4.8	Valve panels
Laser Star, 4.5	3000 series regulator
Semiconductor, 4.0	Valve panels
Anaerobic, 4.0	3000 series regulator
Instrument (Coleman), 4.0	2000 series regulator
Bone Dry, 3.0	2000 series regulator

Carbon Monoxide

CO

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Transportation Information			
UN Number: 1016			
Shipping Name	Carbon Monoxide, Compressed	Carbon Monoxide, Compressed	Carbon Monoxide, Compressed
Hazard Class	2.3 (2.1)	2.3 (2.1)	2.3
Label	Toxic Gas Flammable Gas	Toxic Gas Flammable Gas	Toxic Gas Flammable Gas

(M)SDS Reference
P-4576

CAS Number
630 - 08 - 0

General Description
Colorless, odorless, toxic, flammable gas.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2	THC[1]	H_2	Iron Pentacarbonyl
Semiconductor, 5.0	99.999%	CO 5.0SP	AT	10	0.5	1	3	0.5	–	–
Research, 4.8	99.998%	CO 4.8RS	T, K, Q	20	10	5	20	5	1	0.5
Ultra High Pure, 3.0	99.9%	CO 3.0UH	T, K, Q	200	10	10	50	10	–	–
High Purity, 2.5	99.5%	CO 2.5	T, K, Q	4500	100	20	50	–	–	–
Chemically Pure (CP), 1.85	98.5%	CO 1.85	T, K, Q	–	–	20	50	–	–	–

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

(1) As Methane CH_4

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume ft³ (m³)	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	350/724	2000 (138)	244 (6.77)	160 (73)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/724	1660 (114)	181 (5.02)	145 (66)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	350	1660 (114)	61 (1.69)	69 (36)
AT	High Pressure Aluminum	54 x 10 (137.2 x 25.4)	350/724	2200 (154)	254 (7.19)	112 (51)

Equipment Recommendations

Semiconductor, 4.8	Gas cabinets
Research, 4.8	Gas cabinets, valve panels
Ultra High Pure, 3.0	4000 series regulator
High Purity, 2.5	3000 series regulator
Chemically Pure (CP), 1.85	2000 series regulator

Five Valve Control Panel
(see page E•299)

Chlorine

Cl_2

Transportation Information

UN Number: 1017

Shipping Name	Chlorine	Chlorine	Chlorine
Hazard Class	2.3 (5.1) (8)	2.3 (8)	2.3 (8)
Label	Toxic Gas, Oxidizer, Corrosive	Toxic Gas, Oxidizer, Corrosive	Toxic Gas, Oxidizer, Corrosive

(M)SDS Reference
P-4580

CAS Number
7782 - 50 - 5

General Description
Greenish-yellow, highly toxic, corrosive, oxidizing, liquefied gas with a pungent, irritating odor.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2	CO	THC
Research, 5.0	99.999%	CL 5.0RS	K	2	1	2	4	0.5	0.1
Chlorine, 4.0	99.99%	CL 4.0	K	50	10	3	20	1	1
Chemically Pure (CP), 2.5	99.5%	CL 2.5	K, CL, Q, G	–	–	–	–	–	–

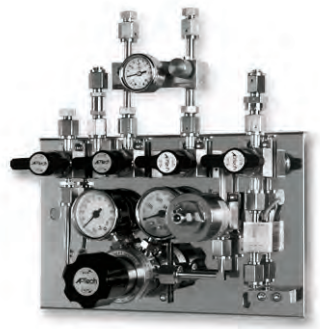
Concentrations given are ppm by volume unless otherwise specified.
Maximum ppm unless otherwise noted.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660/728	85 (5.86)	100 (45.4)	235 (107)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	660	85 (5.86)	40 (18.18)	105 (47.7)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	660	85 (5.86)	19 (8.63)	48 (21.8)
CL	Low Pressure Steel	48 x 10 (121.9 x 25.4)	660	85 (5.86)	150 (68.0)	235 (107)

Equipment Recommendations

Research, 5.0	Gas cabinets, valve panels
Chlorine, 4.0	7000 series regulator
Chemically Pure (CP), 2.5	4055 series regulator



WP5M Manual Process Panel for Hazardous Gas Service
(see page E•307)

Praxair gas cabinets are engineered to provide reliable and safe gas delivery. See Section E for details (pages E•304 - E•306).

Deuterium

D_2

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Transportation Information			
UN Number: 1957			
Shipping Name	Deuterium, Compressed	Deuterium, Compressed	Deuterium, Compressed
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4585

CAS Number
7782 - 39 - 0

General Description
Colorless, odorless, flammable gas; an isotope of hydrogen.

Product/ Grade	Purity	Part Number	Cylinder	N_2	O_2 + Ar	H_2O	CO_2	CO	HD Deuterium Hydride	THC	H_2
Research (Isotopic Enrichment 99.8%), 5.0	99.999%	DT 5.0RS	T, K, Q	1	1	1	1	1	3000	1	100

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume ltr	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	350/724	2351 (163)	7300	146 (66)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/724	1786 (12314)	5000	135 (61)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	350	1918 (13224)	2000	65 (30)

Equipment Recommendations

4012 Series – Critical Purity Regulators for Corrosive Service (see page E•244)

See Section D for Praxair's complete line of instrument support gases and mixtures (pages D•214 - D•218).

See Sections F and G for safety and technical information.

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Dichlorosilane SiH_2Cl_2

Transportation Information

UN Number: 2189

			
Shipping Name	Dichlorosilane	Dichlorosilane	Dichlorosilane
Hazard Class	2.3 (2.1) (8)	2.3 (2.1) (8)	2.3 (2.1) (8)
Label	Toxic Gas, Flammable Gas, Corrosive	Toxic Gas, Flammable Gas, Corrosive	Toxic Gas, Flammable Gas, Corrosive

(M)SDS Reference
P-4587

CAS Number
4109 - 96 - 0

General Description
Colorless, highly toxic, corrosive, flammable, liquefied gas with a sharp, hydrochloric acid odor.

Product/Grade	Purity	Part Number	Cylinder
Semiconductor 3.5	99.95%	DI 3.5SP	K
Semiconductor 3.0	99.9%	DI 3.0SP	K

	Atmospheric Components						Chemical Components			
Product/Grade	N_2 ppm/v	O_2 + Ar ppm/v	CO ppm/v	CO_2 ppm/v	CH_4 ppm/v	C_2, C_3, C_4 ppm/v	MCS ppm/w	TCS ppm/w	STC ppm/w	HCl ppm/w
Semiconductor 3.5	1	1	1	1	1	1	250	200	10	150
Semiconductor 3.0	1	1	–	–	–	–	250	500	200	–

MCS = Monochlorosilane
TCS = Trichlorosilane
STC = Silicon Tetrachloride

	Epi Film Components									
Product/Grade	Al ppb/a	B ppb/a	P ppb/a	As ppb/a	Ga ppb/a	In ppb/a	Sb ppb/a	C ppm/a	O_2 ppm/a	Resistivity ohm-cm
Semiconductor 3.5	0.04	0.05	0.045	0.01	0.01	0.01	0.01	0.1	0.2	> 500
Semiconductor 3.0	0.04	0.05	0.045	0.01	–	–	–	0.1	–	> 400

	Metal Components							
Product/Grade	Fe ppb/w	Ni ppb/w	Cr ppb/w	Na ppb/w	Mo ppb/w	Mn ppb/w	Cu ppb/w	Zn ppb/w
Semiconductor 3.5	1	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Semiconductor 3.0	3	–	–	–	–	–	–	–

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	678/636	9 (.62)	90 (40.9)	210 (95.45)

Contact your Praxair representative about equipment recommendations for Dichlorosilane.

Dimethyl Ether $(CH_3)_2O$

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Transportation Information **UN Number:** 1033			
Shipping Name	Dimethyl Ether	Dimethyl Ether	Dimethyl Ether
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4589

CAS Number
115 - 10 - 6

General Description
Colorless, flammable, liquefied gas with an ethereal odor.

Product/Grade	Purity	Part Number	Cylinder
High Purity, 2.5	99.5% wt% (liquid phase)	DE 2.5	HT, FX/FXS(1), LP5/LP5S(1)

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

(1) FXS and LP5S cylinders include eductor tube.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	510	23.5 (1.62)	500 (227.27)	815 (370.45)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510	23.5 (1.62)	100 (45.36)	180 (82)
LP5/LP5S	Low Pressure Steel	17.7 x 12 (44.9 x 30.5)	510	23.5 (1.62)	20 (9.07)	38 (17.2)

Equipment Recommendations

3002 Series – High Purity Regulator for Non-Corrosive Service
(see page E•251)

See our full line of safety equipment (pages E•405 - E•409) and gas cabinets (pages E•304 - E•306).

See Sections F and G for safety and technical information.

Ethane

C_2H_6

Transportation Information			
UN Number: 1035			
Shipping Name	Ethane	Ethane	Ethane
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

MSDS Reference
P-4592

CAS Number
74 - 84 - 0

General Description
Colorless, odorless, flammable, liquefied gas.

Product/Grade	Purity	Part Number	Cylinder	H_2O	N_2	O_2	CO_2 + CO	THC
Research, 5.0	99.999%	ET 5.0RS	K, Q, G	3	3	1	2	6
Chemically Pure (CP), 2.0	99.0%	ET 2.0	K, Q, G	10	500	200	200	0.9%

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350	543 (37.44)	32 (14.5)	165 (75)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	350	543 (37.44)	11 (5.0)	76 (35)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	350	543 (37.44)	5 (2.3)	36 (16)

Equipment Recommendations

Research, 5.0	3000 series regulator
Chemically Pure (CP), 2.0	2000 series regulator

2012 Series – High Purity Economical Regulator for Non-Corrosive Service
(see page E•256)

See Section D for additional information on Praxair products for the Hydrocarbon Processing Industry (pages D•175 - D•184).

See Sections F and G for safety and technical information.

Ethylene C_2H_4

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Transportation Information **UN Number:** 1962			
Shipping Name	Ethylene	Ethylene, Compressed	Ethylene
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4598

CAS Number
74 - 85 - 1

General Description
Colorless, flammable gas with a sweet odor and taste.

Product/Grade	Purity	Part Number	Cylinder	O_2	H_20	CO_2	CO	N_2	Acetylene	Other THC
Research, 5.0	99.999%	EY 5.0RS	T, K, Q	2	3	2	2	2	2	8
Polymer, 3.0	99.9%	EY 3.0PL	T, K, Q	20	5	10	3	100	8	800
High Purity, 2.5	99.5%	EY 2.5	T, K, Q	100	5	15	5	300	–	4000
Chemically Pure (CP), 1.85	98.5%	EY 1.85	T, K	–	–	–	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	350	1600 (110.31)	37 (16.7)	180 (82)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350	1200 (82.74)	30 (13.6)	163 (74)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	350	1200 (82.74)	10 (4.5)	75 (34)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	350	1200 (82.74)	4.5 (2)	35 (15.9)

Cylinder packs and tube trailers are available upon request.

Equipment Recommendations

Research, 5.0	4000 series regulator
Polymer, 3.0	3000 series regulator
High Purity, 2.5	3000 series regulator
Chemically Pure (CP), 1.85	2000 series regulator

2012 Series – High Purity Economical Regulator for Non-Corrosive Service
(see page E•256)

See Section D for additional information on Praxair products for the Hydrocarbon Processing Industry (pages D•175 - D•184).

See Sections F and G for safety and technical information.

Germanium Tetrafluoride

GeF_4

Transportation Information			
UN Number: 3308			
Shipping Name	Liquefied Gas, Toxic, Corrosive, N.O.S. Germanium Tetrafluoride	Liquefied Gas, Toxic, Corrosive, N.O.S. Germanium Tetrafluoride	Liquefied Gas, Toxic, Corrosive, N.O.S. Germanium Tetrafluoride
Hazard Class	2.3 (8)	2.3 (8)	2.3 (8)
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4822

CAS Number
7783 - 58 - 6

General Description
A colorless, toxic, corrosive gas.

Product/Grade	Purity	Part Number	Cylinder	N_2	$Ar + O_2$	CO_2	CO	CF_4	HF	SO_2
Semiconductor, 4.0	99.99%	GT 4.0	G, ELB	10	20	5	10	10	35	10

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume gr (kg)	Gross Weight lb (kg)
G	High Pressure Steel	20 X 6 (50.8 x 15.2)	330/642	205 (14.1)	8000 (8)	47 (21)
ELB	High Pressure Steel	16 x 2 (40.6 x 5.1)	330/642	205 (14.1)	400 (0.4)	8 (4)

Equipment Recommendations

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

Enriched Germanium Tetrafluoride $Ge_{72}F_4$

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Transportation Information **UN Number:** 3308			
Shipping Name	Liquefied Gas, Toxic, Corrosive, N.O.S. Germanium Tetrafluoride	Liquefied Gas, Toxic, Corrosive, N.O.S. Germanium Tetrafluoride	Liquefied Gas, Toxic, Corrosive, N.O.S. Germanium Tetrafluoride
Hazard Class	2.3 (8)	2.3 (8)	2.3 (8)
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

MSDS Reference
P-19-6362-E

CAS Number
848094 - 33 - 7

General Description
A colorless, toxic, corrosive gas.

Product/Grade	Purity	Part Number	Cylinder	Ge_{72} Isotopic Enrichment	N_2	Ar + O_2	CO_2	CO	SO_2
Semiconductor, 4.0	99.99%	GT 4.0EN	G, LB, *UpTime*®	50-52% Atomic	25	50	25	25	25

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume gr (kg)	Gross Weight lb (kg)
G	High Pressure Steel	20 X 6 (50.8 x 15.2)	330/642	205 (14.1)	8000 (8)	47 (21)
LB	High Pressure Steel	16 x 2 (40.6 x 5.1)	330/642	205 (14.1)	400 (0.4)	8 (4)
UpTime	Sub-Atmospheric	See page D•146 for all sub-atmospheric ion implant packaging.				

Equipment Recommendations

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

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Halocarbon-14
(Tetrafluoromethane)

CF_4

Transportation Information

UN Number: 1982

Shipping Name	Tetrafluoromethane	Tetrafluoromethane	Tetrafluoromethane
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

M(SDS) Reference
P-4665

CAS Number
75 - 73 - 0

General Description
Colorless, nonflammable gas.

Product Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2	CO	Halocarbons	CH_4	SF_6	Acidity (HF)
Semiconductor, 5.0	99.999%	HA 145.0SP	K, G	5	2	1	1	1	2	1	1	0.1 ppm/wt
Semiconductor, 4.7	99.997%	HA 144.7SP	K, G	15	5	1	1	1	4	1	1	0.1 ppm/wt
Semiconductor, 4.0	99.99%	HA 144.0SP	K, G	60	15	1	5	5	10	3	1	0.1 ppm/wt
Semiconductor, 3.0	99.9%	HA 143.0SP	K, G	400	100	5	5	5	20	–	5	1 ppm/wt

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	580/716	2000 (139)	70 (32.7)	200 (91)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	580/716	2000 (139)	12 (5.4)	41 (18.6)

Equipment Recommendations

Semiconductor, 5.0	Valve panels
Semiconductor, 4.7	Valve panels
Semiconductor, 4.0	7000 and 4000 series regulators
Semiconductor, 3.0	7000 and 4000 series regulators

UP2 Manual Purge Panel
(see page E•307)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

Praxair is a full service supplier for all your halocarbon needs.

Halocarbon-23
(Trifluoromethane)

CHF_3

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Transportation Information

UN Number: 1984

Shipping Name	Trifluoromethane	Trifluoromethane	Trifluoromethane
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

M(SDS) Reference
P-4668

CAS Number
75 - 46 - 7

General Description
Colorless, nonflammable, liquefied gas with a slight ethereal odor.

Product/ Grade	Purity	Part Number	Cylinder	N_2	O_2	CO_2	H_2O	Other Halocarbons	Acidity
Semiconductor, 5.0	99.999%	HA 235.0SP	K, G	6	2	2	1	1	1 ppm/wt
Semiconductor, 4.0	99.99%	HA 234.0SP	K, G	60	20	20	10	10	1 ppm/wt
Semiconductor, 2.0	99.0%	HA 232.0SP	K, G	5000 (Air)		–	10	1000	1 ppm/wt

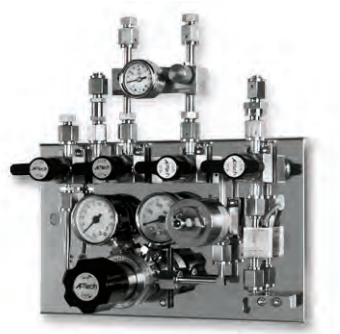
Concentrations given are ppm by volume unless otherwise specified.
Maximum ppm unless otherwise noted.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660/716	635 (43.78)	70 (31.8)	205 (93)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	660/716	635 (43.78)	12 (5.4)	41 (18.6)

Equipment Recommendations

Semiconductor, 5.0	Valve panels
Semiconductor, 4.0	Valve panels
Semiconductor, 2.0	7000 and 4000 series regulators



WP5M Manual Process Panel for Hazardous Gas Service (see page E•307)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

Praxair, your source for technical support.

Halocarbon-32
(Difluoromethane)

CH_2F_2

Transportation Information

UN Number: 3252

Shipping Name	Difluoromethane	Difluoromethane	Difluoromethane
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

M(SDS) Reference
P-6205-B

CAS Number
75 - 10 - 5

General Description
Colorless, flammable gas with a slight ether-like odor.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	CO_2	H_2O	Other Halocarbons	Acidity ppm/w
Semiconductor, 4.5	99.995%	HA 324.5SP	K, G	20	5	2	2	25	0.2
Semiconductor, 4.0	99.99%	HA 324.0SP	K, G	40	10	5	5	100	0.2

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/724	215 (14.82)	65 (29.5)	185 (84)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	350/724	215 (14.82)	9 (4.1)	38 (17)

Equipment Recommendations

Semiconductor, 4.5	Valve panels
Semiconductor, 4.0	7000 and 4000 series regulators

7002 Regulator
(see page E•278)

Halocarbon-41
(Methyl Fluoride)

CH_3F

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Transportation Information

UN Number: 2454

Shipping Name	Methyl Fluoride	Methyl Fluoride	Methyl Fluoride
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4623

CAS Number
593 - 53 - 3

General Description
Colorless, flammable gas with a agreeable ethereal odor.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O
Semiconductor, 4.0	99.99%	HA 414.0SP	K, G	80	20	10
Semiconductor, 3.0	99.9%	HA 413.0SP	K, G	400	100	20

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/724	487 (33.5)	30 (13.6)	163 (74)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	350/724	487 (33.5)	5 (2.2)	34 (15)

Equipment Recommendations

Semiconductor, 4.5	Valve panels
Semiconductor, 4.0	7000 and 4000 series regulators

7002 Regulator
(see page E•278)

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Halocarbon-116
(Hexafluoroethane)

C_2F_6

Transportation Information **UN Number:** 2193			
Shipping Name	Hexafluoro-ethane	Hexafluoro-ethane, Compressed	Hexafluoro-ethane
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4670

CAS Number
76 - 16 - 4

General Description
Colorless, odorless, nonflammable, liquefied gas.

Product/ Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2	CO	Other Halocarbons	Acidity (HCl)
Semiconductor, 5.0	99.999%	HA 1165.0SP	K, G	4	1	3	1	1	5	0.1 ppm/wt
Semiconductor, 4.6	99.996%	HA 1164.6SP	K, G	20	5	2	3	2	10	0.1 ppm/wt
Semiconductor, 3.6	99.96%	HA 1163.6SP	K, G	100	25	10	5	5	50	0.1 ppm/wt

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660/716	430 (26.65)	95 (43.1)	230 (105)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	660/716	430 (26.65)	17 (7.7)	46 (21)

Equipment Recommendations

Semiconductor, 5.0	Valve panels
Semiconductor, 4.6	7000 and 4000 series regulators
Semiconductor, 3.6	7000 and 4000 series regulators

7002 Regulator
(see page E•278)

Praxair's extensive distribution network ensures on-time delivery.

Bulk quantities available upon request.

Halocarbon-134A
(1,1,1,2-Tetrafluoroethane)

$C_2H_2F_4$

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Transportation Information **UN Number:** 3159			
Shipping Name	1,1,1,2-Tetrafluoroethane	1,1,1,2-Tetrafluoroethane	1,1,1,2-Tetrafluoroethane
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-6213

CAS Number
811 - 97 - 2

General Description
Colorless, nonflammable, liquefied gas with a slight ethereal odor.

Product/Grade	Purity	Part Number	Cylinder
Refrigerant, 2.8	99.8% (liquid phase)	RF 134A	FC, D7

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
FC	Low Pressure Steel	47 x 10 (119.4 x 25.4)	660	71 (4.90)	125 (56.7)	175 (79)
D7	Low Pressure Steel	16 x 9 (41.9 x 22.9)	1/2" Acme	71 (4.90)	30 (13.6)	36 (16.5)

Equipment Recommendations

3002 Series – High Purity Regulators for Non-Corrosive Service (see page E•251)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

See Sections F and G for safety and technical information.

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Halocarbon-218
(Octafluoropropane)

C_3F_8

Transportation Information **UN Number:** 2424			
Shipping Name	Octafluoro-propane	Octafluoro-propane	Octafluoro-propane
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4640

CAS Number
76 - 19 - 7

General Description
Colorless, nonflammable, liquefied gas.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	CO	CO_2	H_2O	Other Halocarbons	Acidity (HF)
Semiconductor, 4.0	99.99%	HA 2184.0SP	K, G	< 40	< 10	< 5	< 5	< 10	< 40	0.1 ppm/wt
Semiconductor, 3.7	99.97%	HA 2183.7SP	K, G	< 150	< 40	< 5	< 10	< 5	< 50	0.1 ppm/wt
Semiconductor, 3.6	99.96%	HA 2183.6SP	K, G	< 200	< 50	–	< 10	< 10 ppm/wt	< 50	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660/716	100 (6.89)	100 (45)	223 (101)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	660/716	100 (6.89)	15 (6.8)	44 (20)

Equipment Recommendations

Semiconductor, 4.0	Valve panels
Semiconductor, 3.7	7000 and 4000 series regulators
Semiconductor, 3.6	7000 and 4000 series regulators

7002 Regulator
(see page E•278)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

Not for use in pneumatic retinopexy.

Contact your nearest Praxair location or call 1-877-PRAXAIR for technical information and assistance.

Halocarbon-C318
(Octafluorocyclobutane)

C_4F_8

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Transportation Information			
UN Number: 1976			
Shipping Name	Octafluoro-cyclobutane	Octafluoro-cyclobutane	Octafluoro-cyclobutane
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4671

CAS Number
115 - 25 - 3

General Description
Colorless, nonflammable, liquefied gas.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	Other Halocarbons	Acidity (HF)
Semiconductor, 5.0	99.999%	HA C3185.0SP	K, G, HT	3	1	1 ppm/wt	4	0.1 ppm/wt
Semiconductor, 4.5	99.995%	HA C3184.5SP	K, G, HT	18	4	10	20	0.1 ppm/wt
Semiconductor, 3.8	99.98%	HA C3183.8SP	K, G, HT	80	20	50	50	0.3 ppm/wt
Semiconductor, 3.0	99.9%	HA C3183.0SP	K, G, HT	240	60	10	1000	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660/716	25.1 (1.70)	100 (45)	233 (106)
G	High Pressure Steel	31 x 7 (78.7 x 17.8)	660/716	25.1 (1.70)	10 (4.5)	39 (18)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	660	25.1 (1.70)	1200 (545.5)	1515 (688.6)

Equipment Recommendations

Semiconductor, 5.0	Valve panels, 4000 and 3000 series regulators
Semiconductor, 4.5	Valve panels, 4000 and 3000 series regulators
Semiconductor, 3.8	Valve panels, 4000 and 3000 series regulators
Semiconductor, 3.0	Valve panels, 4000 and 3000 series regulators

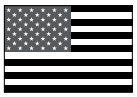
3002 Series – High Purity Regulators for Non-Corrosive Service (see page E•251)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

See Section E for our full line of gas handling equipment and delivery systems.

Helium

He

Transportation Information			
UN Number: 1046			
Shipping Name	Helium, Compressed	Helium, Compressed	Helium, Compressed
Hazard Class	2.1	2.1	2.1
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4602

CAS Number
7440 - 59 - 7

General Description
Colorless, odorless, nonflammable inert gas.

Product/Grade	Purity	Part Number	Cylinder	N_2	O_2	H_20	CO_2	CO	THC	H_2	Ne	Ar	Halogens
Research, 6.0	99.9999%	HE 6.0RS	T, K	0.4	0.1	0.2	0.1	0.1	0.1	0.5	–	0.5	–
Chromatography, 6.0	99.9999%	HE 6.0CH	T,K	–	0.5	0.2	0.1	0.1	0.1	–	–	–	–
Semiconductor, 6.0	99.9999%	HE 6.0SP	T, K	0.5	0.2	0.2	0.1	0.1	0.1	0.1	–	–	–
Trace Analytical, 5.5	99.9995%	HE 5.5TG	T, K	2	1	2	0.5	0.5	0.1	–	–	1	500 ppt[1]
Semiconductor, 5.5	99.9995%	HE 5.5SP	T, K	2	0.5	0.5	0.5	0.5	0.5	–	–	–	–
Laser Star, 5.5	99.9995%	HE 5.5LS	AT	–	1	1	–		0.1	–	–	–	50 ppt[2]
Ultra High Purity Plus, 5.5	99.9995%	HE 5.5UP	T, K, packs, tubes	3	1	1	0.5	0.5	0.5	–	–	–	–
Semiconductor, 5.0	99.999%	HE 5.0SP	T, K	6	2	3	1	1	1	–	–	–	–
Ultra High Purity, 5.0	99.999%	HE 5.0UH	T, K, packs, tubes	5	1	2	–	–	0.5	–	–	–	–
Laser Star, 5.0	99.999%	HE 5.0LS	T, K	–	1	2	–	–	0.5	–	–	–	–
Laser Star, 4.7	99.997%	HE 4.7LS	T, K	–	3	3	–	–	1	–	–	–	–
Zero, 4.8	99.998%	HE 4.8Z	T, K	–	4	3	–	–	0.5	–	–	–	–
High Purity, 4.8	99.998%	HE 4.8	6K, 4K, 3K, T, K	–	5	5	–	–	–	–	–	–	–

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

(1) No peaks exceed the equivalent of 500 ppt Halogens.
(2) No peaks exceed the equivalent of 50 ppt Halogens.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume ft³ (m³)	Gross Weight lb (kg)
6K	Ultra High Pressure Steel	51 x 10 (129.5 x 24.4)	677	6000 (460)	519 (14.39)	308 (140)
4K	Ultra High Pressure Steel	91 x 9.3 (129.5 x 23.5)	680	4500 (310)	432 (11.98)	151 (69)
3K	Ultra High Pressure Steel	51 x 10 (129.5 x 24.4)	680	3500 (268)	333 (9.23)	192 (87)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	580/718	2640 (183)	291 (8.2)	146 (66)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	580/718	2200 (154)	218 (6.17)	135 (61)
AT	High Pressure Aluminum	54 x 10 (137.2 x 25.4)	580/718	2200 (154)	110 (49.9)	97 (44)
AS	High Pressure Aluminum	48 x 8 (121.9 x 20.3)	580/718	2000 (139)	135 (3.74)	49 (22)

Cylinder packs and tube trailers are available upon request.

Hydrogen

H_2

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Transportation Information			
UN Number: 1049			
Shipping Name	Hydrogen, Compressed	Hydrogen, Compressed	Hydrogen, Compressed
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4604

CAS Number
1333 - 74 - 0

General Description
Colorless, odorless, flammable gas.

Product/ Grade	Purity	Part Number	Cylinder	N_2	O_2	H_20	CO_2	CO	THC	Ar
Research, 6.0	99.9999%	HY 6.0RS	T, K	0.5	0.1	0.5	0.1	0.1	0.1	0.1
Chromatography, 6.0	99.9999%	HY 6.0CH	T, K,	0.5	0.5	0.5	0.1	0.1	0.1	–
Semiconductor Process, 6.0	99.9999%	HY 6.0SP	T, K	0.5	0.2	0.2	0.1	0.1	0.1	–
Carrier, 5.5	99.9995%	HY 5.5CA	T, K,	3	1	1	0.5	0.5	0.5	–
Semiconductor Process, 5.5	99.9995%	HY 5.5SP	T, K	2	0.5	0.5	0.5	0.5	0.5	–
Ultra High Purity, 5.0	99.999%	HY 5.0UH	T, K, Q	–	1	3	–	–	0.5	–
Semiconductor Process, 5.0	99.999%	HY 5.0SP	T, K	6	2	3	1	1	1	–
Zero, 4.5	99.995%	HY 4.5Z	T, K	–	5	3	–	–	0.5	–
High Purity, 4.5	99.995%	HY 4.5	6K, T, K, Q	–	5	5	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
6K	Ultra High Pressure Steel	51 x 10 (129.5 x 24.4)	703	6000 (460)	484 (13.98)	306 (139)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	350/724	2400 (183)	261 (7.24)	145 (66)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/724	2000 (138)	196 (5.44)	134 (61)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	350	2000 (138)	65 (1.80)	65 (30)

Cylinder packs and tube trailers are available upon request.

Equipment Recommendations

Research, 6.0	Valve panel, 4000 series regulator
Chromatography, 6.0	Valve panel, 4000 series regulator
Semiconductor Process, 6.0	Valve panel, 4000 series regulator
Carrier, 5.5	3000 series regulator
Semiconductor Process, 5.5	3000 series regulator
Ultra High Purity, 5.0	3000 series regulator
Semiconductor Process, 5.0	3000 series regulator
Zero, 4.5	2000 series regulator
High Purity, 4.5	2000 series regulator

Hydrogen Bromide HBr

Transportation Information			
UN Number: 1048			
Shipping Name	Hydrogen Bromide, Anhydrous	Hydrogen Bromide, Anhydrous	Hydrogen Bromide, Anhydrous
Hazard Class	2.3 (8)	2.3 (8)	2.3
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4605

CAS Number
10035 - 10 - 6

General Description
Colorless, toxic, corrosive, nonflammable, liquefied gas with a very irritating odor.

Product/ Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2	CO	CH_4
Semiconductor, 4.5	99.995%	HB 4.5SP	K, G	20	5	5	20	1	1
High Purity, 2.8	99.8%	HB 2.8	K, G	–	–	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	330/634	320 (22)	70 (31.8)	205 (93)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	330/634	320 (22)	10 (4.5)	39 (17)

Equipment Recommendations

Semiconductor, 4.5	Valve panels, 3000 series regulators
High Purity, 2.8	2000 series regulators

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

See our complete line of gas delivery systems in Section E, including gas cabinets, process panels, and controllers (pages E•304 - E•307).

Hydrogen Chloride HCl

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Transportation Information			
UN Number: 1050			
Shipping Name	Hydrogen Chloride, Anhydrous	Hydrogen Chloride, Anhydrous	Hydrogen Chloride, Anhydrous
Hazard Class	2.3 (8)	2.3 (8)	2.3
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4606

CAS Number
7647 - 01 - 0

General Description
Colorless, toxic, corrosive, nonflammable, acidic, liquefied gas with a pungent odor.

Product/ Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2 + CO	THC
Semiconductor, 5.0	99.999%	HC 5.0SP	K, G	3	1	1	4	1
High Purity, 2.0	99.0%	HC 2.0	K, G	–	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	330/634	613 (42)	60 (27.3)	187 (85)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	330/634	613 (42)	9 (4.1)	38 (17.2)

Equipment Recommendations

Semiconductor, 5.0	Gas cabinets, 4000 series regulators
High Purity, 2.0	4000 series regulators

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

See our full line of safety equipment and gas cabinets in Section E.

Product available in ton containers.

See Sections F and G for safety and technical information.

Hydrogen Sulfide H_2S

Transportation Information

UN Number: 1053

Shipping Name	Hydrogen Sulfide	Hydrogen Sulfide	Hydrogen Sulfide
Hazard Class	2.3 (2.1)	2.3 (2.1)	2.3
Label	Toxic Gas, Flammable Gas	Toxic Gas, Flammable Gas	Toxic Gas, Flammable Gas

(M)SDS Reference
P-4611

CAS Number
7783 - 06 - 4

General Description
Colorless, toxic, corrosive, flammable liquefied gas with an offensive odor (rotten eggs).

Product/Grade	Purity	Part Number	Cylinder	CO_2	CS_2	COS	N_2	THC
Ultra Pure, 3.0	99.9%	HS 3.0	K	100	200	600	100	100
Commercial, 2.5	99.5%	HS 2.5	K	500	1000	2000	100	3000

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	330	252 (17.37)	60 (27.27)	197 (9.5)

Equipment Recommendations

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

See our full line of safety equipment and gas cabinets in Section E.

See Sections F and G for safety and technical information.

Isobutane

$i\text{-}C_4H_{10}$

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Transportation Information

UN Number: 1969

Shipping Name	Isobutane	Isobutane	Isobutane
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4613

CAS Number
75 - 28 - 5

General Description
Colorless, flammable, liquefied gas with a slight odor.

Product/Grade	Purity	Part Number	Cylinder	H_2O	N_2	O_2	Other THC	Sulfur
Research, 4.0	99.99 wt% (liquid phase)	IS 4.0RS	FX/FXS, LP5	3	20	5	90 wt	1 wt
Instrument, 2.5	99.5 wt% (liquid phase)	IS 2.5IS	HT, FX/FXS, LP5	5	400	100	0.49%	1 wt
Chemically Pure (CP), 2.0	99.0 wt% (liquid phase)	IS 2.0	HT, FX/FXS LP5	10	800	200	0.9%	1 wt

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	510	31 (2.14)	490 (222.7)	805 (365.9)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510/555	31 (2.14)	116 (52.6)	191 (87)
LP5	Low Pressure Steel	17.6 x 12 (44.85 x 30.48)	510	31 (2.14)	23 (10.4)	41 (18.6)

Equipment Recommendations

Research, 4.0	3000 series regulators
Instrument, 2.5	2000 series regulators
Chemically Pure (CP), 2.0	2000 series regulators

2002 Series – High Purity Economical Regulator
(see page E•257)

See Section D for additional information on Praxair products for the Hydrocarbon Processing Industry (pages D•175 - D•184).

See Sections F and G for safety and technical information.

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Isobutylene

C_4H_8

Transportation Information

UN Number: 1055

Shipping Name	Isobutylene	Isobutylene	Isobutylene
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4614

CAS Number
115 - 11 - 7

General Description
Colorless, flammable, liquefied gas with a coal gas odor.

Product/Grade	Purity	Part Number	Cylinder	H_2O	Other THC	Sulfur
High Purity, 2.5	99.5 %wt (liquid phase)	IY 2.5HP	HT, FX/FXS, LP5	5	0.49%	1 wt
Chemically Pure (CP), 2.0	99.0 %wt (liquid phase)	IY 2.0	HT, FX/FXS, LP5	10	0.9%	1 wt

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	510	24.3 (1.68)	530 (240.9)	845 (384.1)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510/555	24.3 (1.68)	125 (56.7)	200 (91)
LP5	Low Pressure Steel	17.7 x 12 (44.9 x 30.5)	510	24.3 (1.68)	25 (11.3)	43 (19.5)

Equipment Recommendations

High Purity, 2.5	3000 and 2000 series regulators
Chemically Pure (CP), 2.0	3000 and 2000 series regulators

3002 Series – High Purity Regulators for Non-Corrosive Service (see page E•251)

See Section D for additional information on Praxair products for the Hydrocarbon Processing Industry (pages D•175 - D•184).

Contact your nearest Praxair location or call 1-877-PRAXAIR for technical information and assistance.

Krypton

Kr

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Transportation Information			
UN Number: 1056			
Shipping Name	Krypton, Compressed	Krypton, Compressed	Krypton, Compressed
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4616

CAS Number
7439 - 90 - 9

General Description
Colorless, odorless, nonflammable, inert gas.

Product/ Grade	Purity	Part Number	Cylinder	N_2	O_2	H_2O	CO_2	THC	Xe + Ar + H_2	CF_4
Research, 5.0	99.999%	KR 5.0RS	T, K, Q, D4, D8, ELB	5	2	3	0.5	0.2	4	3

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume ltr	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	580/718	2218 (125)	10000	219 (99)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	580/718	1792 (124)	7000	187 (85)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	580/718	1557 (1074)	2000	80 (37)
D4	Non-Refillable Steel	4.25 x 13 (10.8 x 33.02)	580	1462 (101)	300	10 (5)
D8	Non-Refillable Steel	4.25 x 7.75 (10.8 x 19.69)	580	1311 (90)	100	6 (2.7)
ELB	Non-Refillable Steel	2 x 14.25 (5.08 x 36.20)	580	1119 (77)	50	6 (2.7)
ELB	Non-Refillable Steel	2 x 14.25 (5.08 x 36.20)	580	647 (45)	25	5 (2.3)

Equipment Recommendations

3012 Series – High Purity Regulators for Non-Corrosive Service
(see page E•250)

Praxair, the leader in rare gas production and application technology.

See Sections F and G for safety and technical information.

Methane CH_4

Transportation Information			
UN Number: 1971			
Shipping Name	Methane, Compressed	Methane, Compressed	Methane, Compressed
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4618

CAS Number
74 - 82 - 8

General Description
Colorless, odorless, flammable gas.

Product/Grade	Purity	Part Number	Cylinder	O_2	H_2O	N_2	C_2H_6	Other THC
Research, 5.0	99.999%	ME 5.0RS	T, K, Q	2	2	5	5	2
Ultra High Purity Plus, 4.0	99.99%	ME 4.0UP	T, K, Q	5	5	40	60	10
Ultra High Purity, 3.7	99.97%	ME 3.7UH	T, K, Q	10	5	100	–	250
Chemically Pure (CP), 2.0	99.0%	ME 2.0	T, K, Q	500	10	2000	–	8000
Commercial, 1.3	93.0%	ME 1.3	T, K, Q	–	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft³ (m³)	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	350	2400 (165)	346 (9.59)	162 (74)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350	2000 (138)	255 (7.07)	144 (65)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	350	2000 (138)	85 (2.36)	69 (31)

Equipment Recommendations

Research, 5.0	Valve panels, 4000 series regulators
Ultra High Purity Plus, 4.0	3000 series regulators
Ultra High Purity, 3.7	3000 series regulators
Chemically Pure (CP), 2.0	2000 series regulators
Commercial, 1.3	2000 series regulators

2012 Series – High Purity Economical Regulator for Non-Corrosive Service
(see page E•256)

See Section D for additional information on Praxair products for the Hydrocarbon Processing Industry (pages D•175 - D•184).

Bulk quantities available upon request. Contact your Praxair representative for details.

Methyl Chloride CH_3Cl

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Transportation Information			
UN Number: 1063			
Shipping Name	Methyl Chloride	Methyl Chloride	Methyl Chloride
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

MSDS Reference
P-4622

CAS Number
74 - 87 - 3

General Description
Colorless, flammable, liquefied gas with an ethereal odor.

Product/ Grade	Purity	Part Number	Cylinder	Chloroethane	H_2O	Acidity (HCl)	Residue
High Purity, 3.5	99.95 wt% (liquid phase)	MC 3.5	HT, FX/FXS	60 wt	50 wt	10 wt	10 wt
Chemically Pure (CP), 2.5	99.5% (liquid phase)	MC 2.5	HT, FX/FXS	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	510	59 (4.07)	830 (377.3)	1145 (520.4)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510/555	59 (4.07)	175 (79.5)	250 (113.6)

Equipment Recommendations

3002 Series – High Purity Regulator for Non-Corrosive Service
(see page E•252)

See Section E for our full line of safety products (pages E•405 - E•409).

See Sections F and G for safety and technical information.

Neon

Ne

Transportation Information			
UN Number: 1065			
Shipping Name	Neon, Compressed	Neon, Compressed	Neon, Compressed
Stabilized			
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4629

CAS Number
7440 - 01 - 9

General Description
Colorless, odorless, nonflammable, inert gas.

Product/ Grade	Purity	Part Number	Cylinder	Ar	O_2	H_2O	THC	N_2	He
Research, 5.0	99.999%	NE 5.0RS	T, K, Q, D4, D8, ELB	1	1	1	0.5	5	4

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume ltr	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	580/718	2371 (163)	7500	154 (70)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	580/718	1745 (120	5000	142 (55)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	580/718	1545 (107)	1500	68 (30.9)
D4	Non-Refillable Steel	4.25 x 13 (10.8 x 33.02)	580	1931 (144)	300	10 (5)
D8	Non-Refillable Steel	4.25 x 7.75 (10.8 x 19.69)	580	1675 (115)	100	6 (2.7)
ELB	Non-Refillable Steel	2 x 14.25 (5.08 x 36.20)	580	1486 (103)	50	6 (2.7)
ELB	Non-Refillable Steel	2 x 14.25 (5.08 x 36.20)	580	721 (50)	25	5 (2.2)

Equipment Recommendations

4032 Series – Critical Purity Regulator for Corrosive Service (see page E•247)

Praxair, the leader in rare gas production and application technology.

See Sections F and G for safety and technical information.

Nitric Oxide

NO

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Transportation Information			
UN Number: 1660			
Shipping Name	Nitric Oxide, Compressed	Nitric Oxide, Compressed	Nitric Oxide, Compressed
Hazard Class	2.3 (5.1) (8)	2.3 (5.1) (8)	2.3
Label	Toxic Gas, Oxidizing, Corrosive	Toxic Gas, Oxidizing, Corrosive	Toxic Gas, Oxidizing, Corrosive

(M)SDS Reference
P-4632

CAS Number
10102 - 43 - 9

General Description
Colorless, highly toxic, oxidizing gas with a slightly irritating odor.

Product/ Grade	Purity	Part Number	Cylinder	N_2	H_2O	CO_2	N_2O
2.5	99.5%	NO 2.5	K, Q, G	2500	20	1000	1200

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft^3 (m^3)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660	500 (34.47)	56 (1.55)	140 (63)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	660	500 (34.47)	19 (0.53)	68 (30.8)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	660	500 (34.47)	9 (0.25)	32 (14.5)

Equipment Recommendations

4032 Series – Critical Purity Regulator for Corrosive Service (see page E•247)

Contact your nearest Praxair location or call 1-877-PRAXAIR for technical information and assistance.

See Sections F and G for safety and technical information.

Nitrogen

N_2

Transportation Information

UN Number: 1066

			
Shipping Name	Nitrogen, Compressed	Nitrogen, Compressed	Nitrogen, Compressed
Hazard Class	2.2 Nonflammable Gas	2.2 Nonflammable Gas	2.2 Nonflammable Gas
Label			

(M)SDS Reference

P-4631

CAS Number

7727 - 37 - 9

General Description

Colorless, odorless, nonflammable inert gas.

Product/Grade	Purity	Part Number	Cylinder	O_2	H_2O	CO_2	CO	THC	H_2	NOx	N_2O	SO_2	SF_6	Halogens
Research, 6.0	99.9999%	NI 6.0RS	T, K	0.5	0.2	0.1	0.1	0.1	–	–	–	–	–	–
Chromatography, 6.0	99.9999%	NI 6.0CH	T, K,	0.5	0.5	0.1	0.1	0.1	–	–	–	–	–	–
Semiconductor, 6.0	99.9999%	NI 6.0SP	T, K	0.2	0.2	0.1	0.1	0.1	0.1	–	–	–	–	–
CEM, 5.5	99.9995%	NI 5.5CE	AS, AQ, A3	0.5	2	1	0.5	0.1	–	0.1	–	0.1	–	–
Trace Analytical Grade, 5.5	99.9995%	NI 5.5TG	T, K	1	2	0.1	1	0.1	–	–	–	–	–	500 ppt[1]
LaserStar, 5.5	99.9995%	NI 5.5LS	AT	1	2	–	–	0.1	–	–	–	–	–	50 ppt[2]
Semiconductor, 5.5	99.9995%	NI 5.5SP	T, K	0.5	0.5	0.5	1	0.5	0.5	–	–	–	–	–
Ultra High Purity Plus, 5.3	99.9993%	NI 5.3UP	T, K	1	1	0.5	0.5	0.5	–	–	–	–	–	–
Ultra Zero Ambient Monitoring, 5.0	99.999%	NI 5.0UM	T, K, AS, AQ	2	2	0.5	0.1	0.5	–	0.02	–	0.005	0.001	–
Volatile Organic Compound Free, 5.0	99.999%	NI 5.0VC	AS, AQ, A3	2	2	0.3	0.01	0.1[3]	–	–	–	0.01	–	–
Vehicle Emission Zero (1065), 5.0	99.999%	NI 5.01065	T, K, AS, AQ	2	–	10	1	0.05	–	0.02	0.02	–	–	–
LaserStar, 5.0	99.999%	NI 5.0LS	T, K	1	3	–	–	0.5	–	–	–	–	–	–
Ultra High Purity, 5.0	99.999%	NI 5.0UH	T, K, Q,	1	3	–	–	0.5	–	–	–	–	–	–
Semiconductor, 5.0	99.999%	NI 5.0SP	T, K	1	3	1	2	1	2	–	–	–	–	–
Vehicle Emission Zero, 4.8	99.998%	NI 4.8VE	T, K, AS, AQ	0.5	1	1	0.5	0.1	–	0.1	–	–	–	–
Zero, 4.8	99.998%	NI 4.8Z	T, K,	4	3	–	–	0.5	–	–	–	–	–	–
High Purity, 4.8	99.998%	NI 4.8	6K, 3K, T, K,	5	3	–	–	–	–	–	–	–	–	–

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

(1) No peaks exceed the equivalent of 500 ppt Halogens.
(2) No peaks exceed the equivalent of 50 ppt Halogens.
(3) Can be individually analyzed for customer selected VOC components.

See next page for Nitrogen cylinder specifications and equipment recommendations.

Transportation Information			
UN Number: 1066			
Shipping Name	Nitrogen, Compressed	Nitrogen, Compressed	Nitrogen, Compressed
Hazard Class	2.2 Nonflammable Gas	2.2 Nonflammable Gas	2.2 Nonflammable Gas
Label			

(M)SDS Reference
P-4631

CAS Number
7727 - 37 - 9

General Description
Colorless, odorless, nonflammable inert gas.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume ft³ (m³)	Gross Weight lb (kg)
6K	Ultra High Pressure Steel	51 x 10 (129.5 x 24.4)	677	6000 (460)	488 (13.53)	340 (154)
4K	Ultra High Pressure Steel	91 x 9.3 (129.5 x 23.5)	680	4500 (310)	430 (11.92)	179 (81)
3K	Ultra High Pressure Steel	51 x 10 (129.5 x 24.4)	680	3500 (268)	341 (9.49)	213 (97)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	580/718	2640 (183)	304 (8.43)	165 (75)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	580/718	2200 (154)	228 (6.32)	149 (68)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	580/718	2200 (154)	76 (2.11)	69 (31)
AT	High Pressure Aluminum	54 x 10 (137.2 x 25.4)	580/718	2200 (154)	250 (6.93)	108 (49)
AS	High Pressure Aluminum	48 x 8 (121.9 x 20.3)	580/718	2000 (139)	142 (3.94)	60 (27)
AQ	High Pressure Aluminum	33 x 7.3 (83.8 x 18.4)	580/718	2200 (154)	82 (2.27)	46 (21)
A3	High Pressure Aluminum	16 x 6.9 (40.6 x 17.5)	580/718	2200 (154)	31 (0.86)	20 (9)

Cylinder packs and tube trailers are available upon request

Equipment Recommendations

Research, 6.0	Valve panels, 4000 and 3000 series regulators
Chromatography, 6.0	Valve panels, 4000 and 3000 series regulators
Semiconductor, 6.0	Valve panels, 4000 and 3000 series regulators
CEM, 5.5	3000 series regulators
Trace Analytical Grade, 5.5	3000 series regulators
LaserStar, 5.5	3000 series regulators
Semiconductor, 5.5	3000 series regulators
Ultra High Purity Plus, 5.3	3000 series regulators
Ultra Zero Ambient Monitoring, 5.0	3000 series regulators
Volatile Organic Compound Free, 5.0	3000 series regulators
Vehicle Emission Zero (1065), 5.0	3000 series regulators
LaserStar, 5.0	3000 series regulators
Ultra High Purity, 5.0	3000 series regulators
Semiconductor, 5.0	3000 series regulators
Vehicle Emission Zero, 4.8	2000 series regulators
Zero, 4.8	2000 series regulators
High Purity, 4.8	2000 series regulators

4012 Series – Critical Purity Regulators for Corrosive Service (see page E•244)

Products are also available in larger quantities, such as 6-, 12- and 16- pack cylinder clusters as well as dewars, microbulk, tube trailers and bulk.

See page B•85 for cryogenic liquid nitrogen.

See Section D, Medical Gases for Nitrogen – N.F. Grade (page D•233).

Nitrogen Dioxide NO_2

Transportation Information			
UN Number: 1067			
Shipping Name	Dinitrogen Tetroxide	Dinitrogen Tetroxide	Dinitrogen Tetroxide
Hazard Class	2.3 (5.1) (8)	2.3 (5.1) (8)	2.3
Label	Toxic Gas, Oxidizer, Corrosive	Toxic Gas, Oxidizer, Corrosive	Toxic Gas, Oxidizer, Corrosive

(M)SDS Reference
P-4633

CAS Number
10102 - 44 - 0

General Description
Reddish-brown colored, highly toxic, oxidizing gas with an irritating odor.

Product/Grade	Purity	Part Number	Cylinder
2.5	99.5%*	NX 2.5	K, G

* Liquid phase analysis.

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660	0 (1)	120 (54.6)	253 (115)
G	High Pressure Steel	31 x 7 (78.7 x 17.8)	660	0 (1)	10 (4.5)	39 (18)
	Eductor Tube available upon request					

Equipment Recommendations

4022 Series – Critical Purity Regulator for Corrosive Service (see page E•248)

Contact your nearest Praxair location or call 1-877-PRAXAIR for technical information and assistance.

See Sections F and G for safety and technical information.

Nitrogen Trifluoride NF_3

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Transportation Information			
UN Number: 2451			
Shipping Name	Nitrogen Trifluoride	Nitrogen Trifluoride	Nitrogen Trifluoride
Hazard Class	2.2 (5.1)	2.2 (5.1)	2.2
Label	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer

(M)SDS Reference
P-4854

CAS Number
7783 - 54 - 2

General Description
Colorless, odorless, nonflammable, corrosive, toxic gas.

Product/Grade	Purity	Part Number	Cylinder	O_2	H_2O	N_2	CO_2	N_2O	CF_4	SF_6	CO	CH_4	Acidity
Semiconductor, 4.0	99.99%	NF 4.0SP	K	5	1	5	3	3	40	5	1	1	1

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	330/640	1450 (145)	44 (20)	179 (81)

Equipment Recommendations

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

See our complete line of gas delivery systems in Section E, including gas cabinets, process panels, and controllers.

Nitrous Oxide

N_2O

Transportation Information			
UN Number: 1070			
Shipping Name	Nitrous Oxide	Nitrous Oxide	Nitrous Oxide
Hazard Class	2.2 (5.1)	2.2 (5.1)	2.2
Label	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer

(M)SDS Reference
P-4636

CAS Number
10024 - 97 - 2

General Description
Colorless, odorless, liquefied gas with a slightly sweetish taste and odor.

Product/ Grade	Purity	Part Number	Cylinder	O_2	H_2O	N_2	THC	CO_2	CO	NH_3	NO_2	NO
Semiconductor, 5.5	99.9995%	NS 5.5SP	K, AS	0.5	1	3	0.1	0.5	0.1	0.1	0.1	0.1
Semiconductor, 4.8	99.998%	NS 4.8SP	K, AS	2	3	8	1	2	1	1	1	1
High Purity, 4.0	99.99%	NS 4.0	K	5	3	25	1	10	10	–	–	–
Atomic Absorption, 2.5	99.5%	NS 2.5AA	K	–	–	–	–	–	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	326/712	745 (51.36)	64 (29)	175 (80)
AS	High Pressure Aluminum	48 x 8 (121.9 x 20.3)	326/712	745 (51.36)	39 (17.7)	87 (39.4)

Equipment Recommendations

Semiconductor, 5.5	Valve panels and 4000 series regulators
Semiconductor, 4.8	Valve panels and 4000 series regulators
High Purity, 4.0	3000 series regulators
Atomic Absorption, 2.5	3000 series regulators

4012 Series – Critical Purity Regulator for Corrosive Service (see page E•244)

See Section D, Medical Gases for Nitrous Oxide – U.S.P. Grade (page D·232).

See Sections F and G for safety and technical information.

Oxygen

O_2

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Transportation Information			
UN Number: 1072			
Shipping Name	Oxygen, Compressed	Oxygen, Compressed	Oxygen, Compressed
Hazard Class	2.2 (5.1)	2.2 (5.1)	2.2
Label	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer

(M)SDS Reference
P-4638

CAS Number
7782 - 44 - 7

General Description
Colorless, odorless, highly oxidizing gas.

Product/Grade	Purity	Part Number	Cylinder	H_2O	N_2	THC	CO	CO_2	Ar	Kr	N_2O
Research, 5.0	99.999%	OX 5.0RS	T, K	1	5	0.5	1	1	5	1	–
Semiconductor, 5.0	99.999%	OX 5.0SP	T, K	1	5	0.5	1	1	5	3	–
Ultra High Purity Plus, 4.5	99.995%	OX 4.5UP	T, K	1	10	1	–	–	15	–	–
Ultra High Purity, 4.3	99.993%	OX 4.3UH	T, K, Q	3	10	1	–	–	40	–	–
Hydrocarbon Free, 4.0	99.99%	OX 4.0HC	T, K	–	–	0.1	–	1	–	–	–
Semiconductor, 4.0	99.99%	OX 4.0MO	T, K	3	50	1	1	1	30	–	2
Zero, 2.6	99.6%	OX 2.6Z	T, K	3	–	0.5	–	–	–	–	–
Extra Dry, 2.6	99.6%	OX 2.6	T, K	10	–	–	–	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft^3 (m^3)	Gross Weight lb (kg)
T	High Pressure Steel	55 x 9.3 (139.7 x 23.5)	540	2640 (183)	337 (9.35)	165 (75)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	540	2200 (154)	249 (6.90)	149 (68)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	540	2200 (154)	83 (2.3)	70 (31.8)

Equipment Recommendations

3013 Series – High Purity Regulator for Oxygen Service (see page E•269)

See page B•86 for cryogenic liquid oxygen.

See Section D, Medical Gases for Oxygen – U.S.P. Grade (page D•234).

Bulk quantities available upon request.

Praxair, your source for technical support.

Phosphine PH_3

Transportation Information			
UN Number: 2199			
Shipping Name	Phosphine	Phosphine	Phosphine
Hazard Class	2.3 (2.1)	2.3 (2.1)	2.3
Label	Toxic Gas, Flammable Gas	Toxic Gas, Flammable Gas	Toxic Gas, Flammable Gas

(M)SDS Reference
P-4643

CAS Number
7803 - 51 - 2

General Description
Colorless, highly toxic, flammable gas with a disagreeable, garlic-like odor.

Product/Grade	Purity	Part Number	Cylinder	H_2O	N_2	O_2 + Ar	C2 - C5[1]	CO_2	CO	CH_4	AsH_3
Semiconductor, 6.0	99.9999%	PH 6.0SP	K	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Semiconductor, 5.7	99.9997%	PH 5.7SP	K, *UpTime*®	1	1	0.5	0.1	0.1	0.1	0.1	0.1

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

Note: Phosphine is available in mixtures with balance gases of Argon, Helium, Hydrogen and Nitrogen. Please contact your Praxair representative to discuss your mixture requirements.

[1] Defined as Ethane (C_2H_6), Propane (C_3H_8) , Butane (C_4H_{10}) and Pentane (C_5H_{12}).

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/632	593 (41)	27 (12.25)	160 (73)
UpTime	Sub-Atmospheric	See page D•146 for all sub-atmospheric ion implant packaging.				

Equipment Recommendations

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

See our complete line of gas delivery systems in Section E, including gas cabinets, process panels, and controllers (pages E•304 - E•309).

Propane

C_3H_8

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Transportation Information

UN Number: 1978

Shipping Name	Propane	Propane	Propane
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

MSDS Reference
P-4646

CAS Number
74 - 98 - 6

General Description
Colorless, flammable liquefied gas.

Product/ Grade	Purity	Part Number	Cylinder	H_2O	N_2	O_2	Other THC	CO_2	Isobutane	Sulfur
Research, 4.0	99.99 wt% (liquid phase)	PR 4.0RS	FX, LP5	3	10	2	90 wt	2	–	–
Instrument, 2.5	99.5 wt% (liquid phase)	PR 2.5IS	HT, FX/FXS, LP5	3	–	–	3000 wt	–	2000 wt	1 wt
Chemically Pure (CP), 2.0	99.0 wt% (liquid phase)	PR 2.0	HT, FX/FXS LP5	5	–	–	9000 wt	–	–	1 wt

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	510	109 (7.52)	420 (190.9)	735 (334)
FX/FXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510, 555	109 (7.52)	100 (45.5)	175 (79.5)
LP5	Low Pressure Steel	17.7 x 12 (44.8 x 30.5)	510	109 (7.52)	20 (9)	40 (18.2)

Equipment Recommendations

Research, 4.0	3000 series regulators
Instrument, 2.5	2000 series regulators
Chemically Pure (CP), 2.0	2000 series regulators

2002 Series – High Purity Economical Regulator
(see page E•257)

See Section D for additional information on Praxair products for the Hydrocarbon Processing Industry (pages D•175 - D•184).

Praxair's extensive distribution network ensures on-time delivery.

Propylene

C_3H_6

Transportation Information

UN Number: 1077

Shipping Name	Propylene	Propylene	Propylene
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4648

CAS Number
115 - 07 - 1

General Description
Colorless, flammable, liquefied gas with a faintly sweet odor.

Product/ Grade	Purity	Part Number	Cylinder	H_2O	N_2	O_2	Other THC	CO_2
Research, 4.0	99.99 wt% (liquid phase)	PY 4.0RS	PX/PXS, LP5(1)	2	5	1	90 wt	1
Instrument, 2.5	99.5 wt% (liquid phase)	PY 2.5IS	PX/PXS, HT(1), LP5(1)	5	–	–	4500 wt	–
Chemically Pure (CP), 2.0	99.0 wt% (liquid phase)	PY 2.0	PX/PXS, HT(1), LP5(1)	–	–	–	–	–

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

(1) Cylinder rated for Propylene service.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
PX/PXS	Low Pressure Steel	45 x 15 (114.3 x 38.1)	510, 555	136 (9.37)	100 (45.5)	177 (81)
HT	Low Pressure Steel	55 x 29.8 (139.7 x 75.6)	510	136 (9.37)	420 (190.9)	735 (334)
LP5	Low Pressure Steel	17.7 x 12 (44.8 x 30.5)	510	136 (9.37)	20 (9)	40 (18.2)

Equipment Recommendations

Research, 4.0	3000 series regulators
Instrument, 2.5	2000 series regulators
Chemically Pure (CP), 2.0	2000 series regulators

3002 Series – High Purity Regulator for Non-Corrosive Service
(see page E•251)

See Section D for additional information on Praxair products for the Hydrocarbon Processing Industry (pages D•175 - D•184).

Praxair, your comprehensive supplier for specialty gases and equipment.

Silane SiH_4

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Transportation Information			
UN Number: 2203			
Shipping Name	Silane	Silane, Compressed	Silane
Hazard Class	2.1	2.1	2.1
Label	Flammable Gas	Flammable Gas	Flammable Gas

(M)SDS Reference
P-4649

CAS Number
7803 - 62 - 5

General Description
Colorless, pyrophoric, flammable gas with a repulsive odor.

Product/ Grade	Purity	Part Number	Cylinder	Ar	O_2	CO_2	CO	Total Chlorosilanes	He	Disilane
Semiconductor, 6.0	99.9999%	SI 6.0SP	K	0.05	0.06	0.05	0.05	0.15	1	0.5
Semiconductor, 4.7	99.997%	SI 4.7SP	K	1	0.1	0.5	0.5	0.5	5	–

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

Product/ Grade	Purity	Part Number	Cylinder	H_2	CH_4	N_2	H_2O	Disiloxane	Methylsilane	Resistivity
Semiconductor, 6.0	99.9999%	SI 6.0SP	K	20	0.05	1	0.5	0.5	0.5	>/= 10000 ohm-cm
Semiconductor, 4.7	99.997%	SI 4.7SP	K	100	0.5	5	2	–	–	>/= 7500 ohm-cm

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

(1) C_2, C_3, C_4 = C_2H_6; C_3H_8; C_4H_{10}.

Semiconductor (from polysilicon deposited silane)

Component	Specification Semiconductor 6.0	Specification Semiconductor 4.7
C	0.2 ppm/a	0.4 ppm/a
P	20 ppt/a	100 ppt/a
B	20 ppt/a	40 ppt/a
As	5 ppt/a	20 ppt/a
Al	5 ppt/a	20 ppt/a
Ga, Sb, In	5 ppt/a each	20 ppt/a each
Fe + Cr + Ni + Cu + Zn	1 ppb/a	–

Due to code regulations full containment within a gas cabinet is required for Silane.

See our complete line of gas cabinets, process panels, and controllers (pages E·304 - E·309).

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/632	1040 (72)	22 (10)	155 (70)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	350/632	1040 (72)	11 (5)	144 (65)

Silicon Tetrachloride $SiCl_4$

Transportation Information

UN Number: 1818

Shipping Name	Silicon Tetrachloride	Silicon Tetrachloride	Silicon Tetrachloride
Hazard Class	8	8	8
Label	Corrosive	Corrosive	Corrosive

(M)SDS Reference
P-4824

CAS Number
10026 - 04 - 7

General Description
Colorless, highly toxic, nonflammable liquid with a pungent odor.

Product/ Grade	Purity	Part Number	Cylinder
Semiconductor, 4.0	99.99%	ST 4.0SP	ST55, ST10

HCl	TCS	Other Chlorosilanes	Carbon	Boron	P	As	Al	Resistivity	Other Metals[1]
15 ppm/wt	10 ppm/wt	0.02 %wt	0.05 ppm/a	0.2 ppb/a	1.0 ppb/a	0.05 ppb/a	0.05 ppb/a	1000 ohm-cm	5 ppb/wt

Product/ Grade	Purity	Part Number	Cylinder	HCl	TCS	Al	Fe	Other Metals[2]
Fiber Optic, 4.0	99.99%	ST 4.0FO	ST55, ST10	15 ppm/wt	10 ppm/wt	25 ppb/wt	50 ppb/wt	100 ppb/wt

Product/ Grade	Purity	Part Number	Cylinder	Boron	Carbon	Donor (P & As)	Other Chlorosilanes	Resistivity
Semiconductor, 3.8	99.98%	ST 3.8SP	ST55, ST10, SB	1 ppb/a	1 ppm/a	2 ppb/a	0.06% wt	> 100 ohm-cm

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

Available with hydrogen or nitrogen pressure pads upon request.

(1) Other metals defined as Al, Fe, Ni, Cu, Cr, Mg, Mn, Zn, Ti, < 5 ppb/w each.
(2) Other metals defined as Ni, Cu, Cr, Mg < 100 ppb/w each.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
ST55	Low Pressure Drum	46 x 24 (116.84 x 60.96)	Based on application	0	600 (272)	850 (385)
ST10	Low Pressure Drum	30 x 12 (76.2 x 30.48)	Based on application	0	100 (45)	150 (68)
SB	Low Pressure Drum	44 x 9 (111.7 x 22.8)	Based on application	0	110 (50)	142 (65)

Contact your Praxair representative about equipment recommendations for Silicon Tetrachloride.

Silicon Tetrafluoride

SiF_4

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Transportation Information

UN Number: 1859

Shipping Name	Silicon Tetrafluoride	Silicon Tetrafluoride	Silicon Tetrafluoride
Hazard Class	2.3 (8)	2.3 (8)	2.3 (8)
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4652

CAS Number
7783 - 61 - 1

General Description
Colorless, nonflammable, corrosive and toxic gas with a pungent odor similar to that of hydrochloric acid.

Product/ Grade	Purity	Part Number	Cylinder	Ar + O_2	N_2	CO_2	CO	CH_4	As	B	P	Acidity (HF)
Semiconductor, 4.0	99.99%	SF 4.0SP	K, G, *UpTime*®	1	3	1	1	10	0.5	0.5	0.5	50

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	330/642	900 (61.2)	50 (22.7)	183 (83)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	330/642	900 (61.2)	8 (3.6)	37 (16)
UpTime	Sub-Atmospheric	See page D•146 for all sub-atmospheric ion implant packaging.				

Equipment Recommendations

SurePurge™ 1500 – Two Cylinder Cabinet (see page E•306)

See Section D for additional information on Praxair's Semiconductor product line (pages D•143 - D•148).

Contact your nearest Praxair location or call 1-877-PRAXAIR for technical information and assistance.

Sulfur Dioxide SO_2

Transportation Information			
UN Number: 1079			
Shipping Name	Sulfur Dioxide	Sulfur Dioxide	Sulfur Dioxide
Hazard Class	2.3 (8)	2.3 (8)	2.3
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4655

CAS Number
7446 - 09 - 5

General Description
Colorless, toxic, corrosive, nonflammable, liquefied gas with a sharp, pungent odor.

Product/Grade	Purity	Part Number	Cylinder	H_2O	Residue	Acid as (H_2SO_4)
Anhydrous, 3.8	99.98 wt% (liquid phase)	SD 3.8	CL, K, G	100	75 ppm/wt	25 ppm/wt
Commercial, 3.0	99.0 wt% (liquid phase)	SD 3.0	CL, K, G	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
CL	Low Pressure Steel	47 x 10 (119.4 x 25.4)	660	34 (2.34)	150 (68)	235 (106.8)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	660	34 (2.34)	100 (45.5)	225 (102.3)
G	High Pressure Steel	20 x 6 (50.8 x 15.2)	660	34 (2.34)	19 (8.62)	48 (22)

Equipment Recommendations

4008 Series – Special Purpose Regulator for Corrosive Service
(see page E•272)

Praxair, high quality specialty gases and equipment for your applications.

See Sections F and G for safety and technical information.

Sulfur Hexafluoride SF_6

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Transportation Information

UN Number: 1080

Shipping Name	Sulfur Hexafluoride	Sulfur Hexafluoride	Sulfur Hexafluoride
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4657

CAS Number
2551 - 62 - 4

General Description
Colorless, odorless, nonflammable liquefied gas.

Product/Grade	Purity	Part Number	Cylinder	$O_2 + N_2$	H_2O	Acidity (HF)	CF_4	CO	CO_2	CH_4
Semiconductor, 5.0	99.999%	SH 5.0SP	K, AS	6	2	0.3	5	0.5	0.5	0.1
Semiconductor, 4.5	99.995%	SH 4.5SP	K, AS	50	8	0.7	17	–	–	–
Dielectric[1], 3.0	99.9 wt%	SH 3.0	K	500 ppm/w	8	0.3 ppm/w	500 ppm/w	–	–	–
Semiconductor, 2.8	99.8%	SH 2.8SP	K	1500	8	–	350	–	–	–

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

(1) Meets ASTM D2472 standard specification for Sulfur Hexafluoride.

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	590/716	320 (22)	115 (52.2)	250 (114)
AS	High Pressure Aluminum	48 x 8 (121.9 x 20.3)	590/716	320 (22)	70 (38.1)	120 (55)

Equipment Recommendations

Semiconductor, 5.0	Valve panels and 4000 series regulators
Semiconductor, 4.5	Valve panels and 4000 series regulators
Dielectric, 3.0	2000 series regulators
Semiconductor, 4.5	3000 series regulators

2012 Series – High Purity Economical Regulator for Non-Corrosive Service *(see page E•256)*

Not for use in pneumatic retinopexy.

See Sections F and G for safety and technical information.

Trichlorosilane $SiHCl_3$

Transportation Information

UN Number: 1295

			
Shipping Name	Trichlorosilane	Trichlorosilane	Trichlorosilane
Hazard Class	4.3 (3) (8)	4.3 (3) (8)	4.3
Label	Dangerous When Wet, Flammable Liquid, Corrosive	Dangerous When Wet, Flammable Liquid, Corrosive	Dangerous When Wet, Flammable Liquid, Corrosive

(M)SDS Reference
P-4823

CAS Number
10025 - 78 - 2

General Description
Colorless, corrosive, flammable liquid with an irritating, choking odor.

Product/ Grade	Purity	Part Number	Cylinder	Boron	Carbon	Donor (As + P)	Other Chlorosilanes	Resistivity
Semiconductor, 3.5	99.95%	TC 3.5SP	ST55, ST10	0.12 ppb/a	5 ppm/a	.08 ppb/a	500 ppm/w	>/= 300 ohm-cm
Semiconductor, 3.0	99.9%	TC 3.0SP	ST55, ST10	0.12 ppb/a	5 ppm/a	1.5 ppb/a	1000 ppm/w	>/= 200 ohm-cm

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
ST55	Low Pressure Drum	46 x 24 (116.84 x 60.96)	Based on application	2.0 (0.13)	550 (249.5)	800 (363)
ST10	Low Pressure Drum	30 x 12 (76.2 x 30.48)	Based on application	2.0 (0.13)	90 (40.8)	140 (64)

Contact your Praxair representative about equipment recommendations for Trichlorosilane.

Tungsten Hexafluoride WF_6

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Transportation Information			
UN Number: 2196			
Shipping Name	Tungsten Hexafluoride	Tungsten Hexafluoride	Tungsten Hexafluoride
Hazard Class	2.3 (8)	2.3 (8)	2.3 (8)
Label	Toxic Gas, Corrosive	Toxic Gas, Corrosive	Toxic Gas, Corrosive

(M)SDS Reference
P-4855-D

CAS Number
7783 - 82 - 6

General Description
Colorless, toxic, nonflammable, corrosive, liquefied gas.

Product/ Grade	Purity	Cylinder	HF	O_2/Ar	N_2	CO	CF_4	CO_2	SF_6	SiF_4	Total Metals
Semiconductor, 5.5	99.9995%	K, Q	1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	300 ppb/wt

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA/DISS	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
K	High Pressure Steel	51 x 9 (129.5 x 22.9)	670/638	2.6 (0.18)	110 (50)	230 (104)
Q	High Pressure Steel	31 x 7 (78.74 x 17.78)	670/638	2.6 (0.18)	44 (20)	109 (49)

Equipment Recommendations

UltraPurge™ 400 Gas Cabinet Series
(see page E•306)

Xenon

Xe

Transportation Information **UN Number:** 2036			
Shipping Name	Xenon	Xenon, Compressed	Xenon
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4677

CAS Number
7440 - 63 - 3

General Description
Colorless, odorless, nonflammable, inert gas.

Product/ Grade	Purity	Part Number	Cylinder	O_2	H_2O	N_2	THC	CO_2	Kr + Ar + H_2	CF_4	Ar	CO	H_2	Kr
Aerospace Grade, 5.5	99.9995%	XE 5.5	K, Q	0.1	0.1	1	0.1	0.2	–	0.1	1	0.2	2	2
Research, 5.0	99.999%	XE 5.0RS	K, Q, D4, D8, ELB	1	2	5	1	1	5	–	–	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ltr	Gross Weight lb (kg)
K (10K)	High Pressure Steel	51 x 9 (129.5 x 22.9)	580	970 (67)	10000	252 (114)
K (5K)	High Pressure Steel	51 x 9 (129.5 x 22.9)	580	836 (58)	5000	195 (90)
Q	High Pressure Steel	31 x 7 (78.7 x 17.8)	580	655 (45)	1000	77 (35)
D4	Non-Refillable Steel	13 x 4.25 (33.02 x 10.8)	580	858 (59)	300	10 (5)
D8	Non-Refillable Steel	7.75 x 4.25 (19.69 x 10.8)	580	801 (55)	100	6 (2.7)
ELB 50	Non-Refillable Steel	14.25 x 2 (36.20 x 5.08)	580	796 (55)	50	6 (2.7)
ELB 25	Non-Refillable Steel	14.25 x 2 (36.20 x 5.08)	580	535 (36)	25	5 (2.3)

Equipment Recommendations

Aerospace Grade, 5.5	3000 series regulators
Research, 5.0	3000 series regulators

3012 Series – High Purity Regulators for Non-Corrosive Service
(see page E•250)

See Section D for additional information regarding Praxair's laser gas products (pages D•219 - D•226).

Praxair, the leader in rare gas production and application technology.

Argon
Cryogenic Liquids

Ar

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Transportation Information **UN Number:** 1951			
Shipping Name	Argon, Refrigerated Liquid	Argon, Refrigerated Liquid	Argon, Refrigerated Liquid
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4564

CAS Number
7440 - 37 - 1 (R)

General Description
Colorless, odorless, nonflammable, cryogenic liquid.

Product/ Grade	Purity	Part Number	Cylinder	O_2	H_2O	THC	N_2	CO_2
UHP, 5.0	99.999%	AR 5.0LC	180, 230	2	3	0.5	–	–
ICP, 4.8	99.998%	AR 4.8IC	180, 230	3	2	1	10	1
High Purity, 4.8	99.998%	AR 4.8LC	180, 230	4	3	–	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft^3 (m^3)	Gross Weight lb (kg)
230	Portable Liquid Unit	53 x 26 (134.6 x 66)	580, 295	varies	6080 (172)	928 (421)
180	Portable Liquid Unit	64 x 20 (162 x 50.8)	580, 295	varies	4960 (140)	773 (351)

Equipment Recommendations

4083, 4085, 4084 and 4086 series regulators.
Final SGE recommendation based on withdrawal rate.

4083 and 4085 Series – Critical Purity High Flow Regulators for Non-Corrosive Service (see page E•264)

Contact your Praxair representative on the availability of other container sizes, including Microbulk (see pages A•16 - A•18).

See Sections F and G for safety and technical information.

Carbon Dioxide
Cryogenic Liquids

CO_2

Transportation Information **UN Number:** 2187			
Shipping Name	Carbon Dioxide, Refrigerated Liquid	Carbon Dioxide, Refrigerated Liquid	Carbon Dioxide, Refrigerated Liquid
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4573

CAS Number
124 - 38 - 9 (R)

General Description
Colorless, odorless, nonflammable, slightly acidic, refrigerated liquid.

Product/ Grade	Purity	Part Number	Cylinder	O_2
Anaerobic, 4.0	99.99%	CD 4.0AN	180L	10

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume lb (kg)	Gross Weight lb (kg)
180	Portable Liquid Unit	64 x 20 (162 x 50.8)	320, 320	Varies	400 (182)	730 (331)

Equipment Recommendations

4083, 4085, 4084 and 4086 series regulators.
Final SGE recommendation based on withdrawal rate.

4084 and 4086 Series – Critical Purity High Flow Regulators for Non-Corrosive Service
(see page E•265)

For information about Praxair's dry ice products, contact your local Praxair sales representative.

See Sections F and G for safety and technical information.

Transportation Information **UN Number:** 1963			
Shipping Name	Helium, Refrigerated Liquid	Helium, Refrigerated Liquid	Helium, Refrigerated Liquid
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4600

CAS Number
7440 - 59 - 7 (R)

General Description
Colorless, odorless, nonflammable, cryogenic liquid and gas.

Product/	Purity Grade	Part	Cylinder Number	O_2	N_2	H_2O	CO	CO_2	THC	H_2	Ne
5.0	99.999%	HE LT	LT60, LT100, LT250, LT500	1	5	2	1	1	0.1	1	2

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection	Pressure psig (bar)	Volume lt	Gross Weight lb (kg)
LT60	Portable Liquid Unit	51 x 24 (127.3 x 61)	Coupling for 3/8" or ½" transfer tube	1 (0.07)	60	209 (95)
LT100	Portable Liquid Unit	59 x 24 (147.9 x 61)	Coupling for 3/8" or ½" transfer tube	1 (0.07)	100	249 (113)
LT250	Portable Liquid Unit	67 x 32 (171.1 x 81.3)	Coupling for 3/8" or ½" transfer tube	1 (0.07)	250	526 (239)
LT500	Portable Liquid Unit	70 x 42 (179.3 x 106.7)	Coupling for 3/8" or ½" transfer tube	1 (0.07)	500	824 (374)

Equipment Recommendations

Dewar Changeover System
(see page E•288)

See Sections F and G for safety and technical information.

Nitrogen
Cryogenic Liquids

N_2

Transportation Information			
UN Number: 1977			
Shipping Name	Nitrogen, Refrigerated Liquid	Nitrogen, Refrigerated Liquid	Nitrogen, Refrigerated Liquid
Hazard Class	2.2	2.2	2.2
Label	Nonflammable Gas	Nonflammable Gas	Nonflammable Gas

(M)SDS Reference
P-4630

CAS Number
7727 - 37 - 9 (R)

General Description
Colorless, odorless, nonflammable, cryogenic liquid.

Product/Grade	Purity	Part Number	Cylinder	O_2	H_20	THC
UHP, 5.0	99.999%	NI 5.0LC	180, 230	1	3	0.5
High Purity, 4.8	99.998%	NI 4.8LC	180, 230	5	3	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft³ (m³)	Gross Weight lb (kg)
230	Portable Liquid Unit	53 x 26 (134.6 x 66)	580, 295	varies	5030 (139)	664 (301)
180	Portable Liquid Unit	64 x 20 (162 x 50.8)	580, 295	varies	4110 (114)	557 (253)

Equipment Recommendations

4083, 4085, 4084 and 4086 series regulators.
Final SGE recommendation based on withdrawal rate.

4084 and 4086 Series – Critical Purity High Flow Regulators for Non-Corrosive Service
(see page E•265)

See Sections F and G for safety and technical information.

Transportation Information **UN Number:** 1073			
Shipping Name	Oxygen, Refrigerated Liquid	Oxygen, Refrigerated Liquid	Oxygen, Refrigerated Liquid
Hazard Class	2.2 (5.1)	2.2 (5.1)	2.2
Label	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer	Nonflammable Gas, Oxidizer

(M)SDS Reference
P-4637

CAS Number
7782 - 44 - 7 (R)

General Description
Odorless, highly oxidizing, light blue, cryogenic liquid.

Product/Grade	Purity	Part Number	Cylinder	N_2	H_2O	THC	Ar
UHP, 4.3	99.993%	OX 4.3LC	230	10	3	1	40
Extra Dry, 2.6	99.6%	OX 2.6LC	230	–	10	–	–

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

Cylinders

Cylinder Type	Style	Size in (cm)	Connection CGA	Pressure psig (bar)	Volume ft³ (m³)	Gross Weight lb (kg)
230	Portable Liquid Unit	53 x 26 (134.6 x 66)	540, 440	varies	5930 (165)	831 (387)

Equipment Recommendations

3003 Series – Oxygen Regulators
(see page E•270)

See Sections F and G for safety and technical information.

Praxair's *StarWatch*™ Cryogenic Monitoring System

The *StarWatch*™ Cryogenic Monitoring System – available exclusively from Praxair – provides a clear digital read-out of the liquid level and pressure in your dewar and alerts you with an audio and visual alarm when your supply runs low. The capacitance-based measurement of the *StarWatch* system provides a leap forward in reliability and accuracy versus conventional float gauges.

When the *StarWatch* system detects the dewar supply to be at or below your alarm levels, the corresponding conditions are displayed on the LCD, and the audiovisual alarms are activated until acknowledged by the user with a single push of a button. When a new low alarm condition is met, corresponding displays and alarms are activated again. Low and critically low alarms have distinct frequencies, so you can quickly assess your dewar and take action as necessary. The *StarWatch* system offers options to disable either the alarms alone or the measurements and alarms together during periods of process inactivity.

Benefits

- Easy-to-read, digital liquid level and pressure indicator
  - Always know the supply level and pressure in your dewar
    ± 2 percent (liquid)
    ± 1 psi (up to 60 psig service)
    ± 10 psi (up to 500 psig service)
  - Reduce the risk of product outage
  - Minimize return of unused liquid
- Adjustable low and critically low level alarms
  - Customize alert levels to your application and operations
  - Enhance security against product outage
- Audible and visual alarm indicators
  - Recognize alarm condition through two different modes of alert
- Dedicated low or high pressure service
  - Select dewars with pressure adjustment system suited to your application
  - Minimize product losses from safety relief valve venting during liquid service

Features

1. Audible and visual alarm beacon.
2. Clear and easy-to-read liquid-crystal display (LCD). Shows the liquid level (percent) and pressure (psi) in the dewar and indicates whether any alarms are active.
3. Connection to electronic pressure gauge on liquid dewar.
4. Buttons to customize alarm set points. There are four different alert levels: low liquid level, critically low liquid level, low pressure, and critically low pressure.

The *StarWatch* system comes equipped on Praxair's *ProSpec*™ cryogenic dewars – high quality liquid packages dedicated to laboratory applications and optimized for either low (liquid) or high (gas) pressure service. The reliable *ProSpec* dewar, combined with the *StarWatch* system's accurate level and pressure reporting, allows you to stay focused on your work, avoiding process interruptions from product outages and the waste associated with residual returns.

Bulk Products

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Praxair focuses on our customers, for whom we supply atmospheric, process, specialty and life support gases. Praxair also provides delivery options and support services for customers.

Praxair can supply multi-cylinder cluster units, tube trailers, cryogenic containers or bulk cryogenic and atmospheric tankage to serve your every need.

Our range of products is equaled only by the variety of services we provide. For example, before we recommend a supply option, our professionals will analyze your operation with you to determine your gas supply requirements and critical factors, including:

- Volumes
- Pressure
- Planned utilization
- Power availability and costs
- Purity
- Usage patterns
- Siting needs

Using this information, we can recommend the total gas supply system that will help you select the gas you need at the lowest cost of ownership and highest reliability.

Delivery Vehicles

	Bulk Liquid Trailer Available	Gaseous Tube Trailer Available
Air		
Argon – Ar		
Carbon Monoxide – CO		
Carbon Dioxide – CO_2		
Ethane – C_2H_6		
Ethylene – C_2H_4		
Helium – He		
Hydrogen – H_2		
Methane – CH_4		
Mixtures		
Natural Gas		
Neon – Ne		
Nitrogen – N_2		
Nitrous Oxide – N_2O		
Oxygen – O_2		
Silane – SiH_4		

Mixtures

Section

C

In this section

- **Hundreds of minor components**
- **Environmental, standard and custom grades**
- **Performance based certification**
- **Stringent SPC-QA/QC programs**
- ***Chemmate*® Custom (M)SDS**

Certification Documents Available

Certificate of Compliance (COC1)
Document that indicates that a product meets or exceeds the minimum purity or analytical accuracy as specified.

Certificate of Conformance (COC2)
Statement of guarantee that the product from a specific batch conforms to the components, minimum purity and maximum impurity specifications.

Certificate of Analysis (COA)
A document that reports the actual analytical test results for pure product or for a calibration mixture. Either single cylinder or batch analysis certification is available.

Available Upon Request!

Grade Specifications

Praxair Grades

Environmental Grades

- **NTRM –** NIST Traceable Reference Materials are certified by the National Institute of Standards and Technology (NIST) and accepted by the Environmental Protection Agency (EPA), as the highest accuracy standards commercially available. These standards are the regulatory equivalent to NIST's Standard Reference Materials (SRMs) and are made up of the same components and are within the analytical range of NIST SRMs.
- **EPA Protocols –** Used for the calibration and audit of Continuous Emission Monitors (CEMs), Praxair EPA Protocols are NIST traceable and produced in accordance with the latest EPA specifications found in document - 600/R97/121 Rev. 9/97.
- **Primary Master –** High accuracy mixtures prepared gravimetrically on electronic high-precision balances. These standards are analyzed and named against NIST traceable reference materials.
- **Certified Master –** These routine calibration mixtures are prepared by either gravimetric, volumetric or partial pressure methods and analyzed against NIST traceable reference materials.
- **Dynamic-Blend Master –** These zero blend tolerance mixtures are prepared on an instrument based dynamic blending system. Batches of cylinders from two to one hundred can be produced with the identical concentrations.
- **Dynamic-Blend Standard –** These mixtures are prepared similarly to the Dynamic Blend Master. Certification of the mixtures is based on process accuracy and Praxair Primary Laboratory Standards (PPLS).

All master gases are analyzed and named against NIST traceable materials.

Standard Grades

- **Primary Standard –** Highly accurate mixtures prepared gravimetrically on high-precision electronic balances. These standards are analyzed against Praxair Primary Laboratory Standards (PPLS) and named to a gravimetrically generated concentration.
- **Certified Standard –** These routine calibration mixtures are prepared by either gravimetric, volumetric or partial pressure methods. These standards are analyzed against Praxair Primary Laboratory Standards (PPLS).
- **Non-Certified –** Mixtures are prepared by the same methods and the same care used for Certified Standard Grades. Analyses are not reported.
- **Custom –** Mixtures prepared to the exact blend tolerance and analytical uncertainty requested.

Grade Specifications

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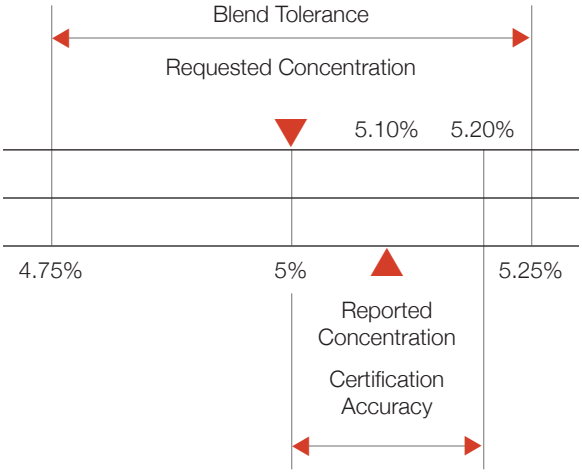
Mixture Grade	Order Reference	Mixture Component Concentration Range	Blend Pre-Tolerance	Analytical Uncertainty
EV – Environmental Grades[1]				
NTRM	T	N/A	N/A	± 1%
EPA Protocol	E	2 - 25 ppm	± 10%	± 1%
		25.1 - 49.9%	± 5%	± 1%
Primary Master	PM	1 - 9.9 ppm	± 10%	± 0.1 ppm
		10 - 25 ppm	± 10%	± 1%
		25.1 - 9999 ppm	± 5%	± 1%
		1.0 - 49.9%	± 2%	± 1%
Certified Master	CM	1 - 9.9 ppm	± 20%	± 0.2 ppm
		10 - 25 ppm	± 20%	± 2%
		25.1 - 9999 ppm	± 10%	± 2%
		1.0 - 49.9%	± 5%	± 2%
Dynamic Blend Master	DM	1 - 99.9 ppm	Zero	± 2%
		100 ppm - 49.9%	Zero	± 1%
Dynamic Blend Standard	D	1 - 99.9 ppm	Zero	± 5%
		100 ppm - 49.9%	Zero	± 2%
ST – Standard Grades				
Primary Standard	P	1 - 9.9 ppm	± 10%	± 0.1 ppm
		10 - 25 ppm	± 10%	± 1%
		25.1 - 9999 ppm	± 5%	± 1%
		0.1% - 49.9%	± 2%	± 1% or 0.02% abs*
Certified Standard	C	1 - 99.9 ppm	± 20%	± 5%
		100 - 999 ppm	± 10%	± 2%
		0.1 - 49.9%	± 5%	± 2%
Non-Certified Standard	U	1 - 999 ppm	± 20%	N/A
		0.1 - 49.9%	± 10%	
Custom Standard	Z	1 ppm - 49.9%	TBD	TBD

* Whichever is smaller.

[1] All Environmental Grades are NIST traceable. Actual ranges, blend tolerance, and analytical uncertainty are based on available National Institute of Standards and Technology (NIST) SRM concentrations. Please see individual components for specific information.

Note: For all mixtures, blend tolerance and analytical uncertainty specification may vary depending on the chemical characteristics of the component and the cylinder size. For mixtures outside of these ranges, please contact your local Praxair representative.

Example:	Relative Value	Absolute Value
Blend Tolerance	± 5% of minor component	± 0.25%
Analytical Uncertainty	± 2% of minor component	± 0.10%



Behind The Scenes

Safe, Accurate, Consistent, Reliable... Every Time

Sophisticated communication programs and mixture blending software (worldwide databases with international access) provide the very latest in mixture technology for our customers.

- **Component Raw Material**
  All blending source gases and liquids are qualified to ensure that they are appropriate for your application. We have determined through experience that certain impurities affect the performance or stability of the final mixture.

  We have developed and used special proprietary purification techniques for the removal of critical impurities. Upon request a complete impurity profile or specific impurity analyses can be provided.

- **Cylinder Preparation**
  Praxair utilizes a series of computer controlled heating, vacuum and purge cycles to prepare both aluminum and steel cylinders.

  For low concentration or highly reactive components we use our additional, proprietary cylinder treatment processes. With the application of these unique cylinder preparation processes, we are able to produce accurate part per billion and low part per million concentration reactive gas mixtures with guaranteed stabilities.

- **Blending Systems**
  Praxair prepares mixtures utilizing high load, high sensitivity Gravimetric Balances, Micro Balance Capillary Injection, Computerized Dynamic Blending Systems and Volumetric Manifolds. In every case we use the method best suited to your application.

  All gravimetric balances are calibrated with NIST traceable weights. All balances, gauges and process instruments undergo specified periodic maintenance and calibration.

- **Mixture Homogenization**
  Once a particular mixture is prepared, mechanical rolling, gas turbulence or molecular agitation is used to ensure the homogeneity of the final mixture.

- **Analytical Instrumentation**
  - Gas Chromatography (GC detectors,- TCD, FID, ECD, HID, DID, FPD, PID, NPD, RGA)
  - Chemiluminescence
  - Fourier Transform Infrared (FTIR)
  - Atomic Absorption (GFAA)
  - Mass Spectroscopy (MS)
  - Fluorescence UV
  - Process Instrumentation (NDIR, O_2, THC, H_2O)

- **Reference Materials**
  - Standard Reference Materials (SRM)
  - NIST Traceable Reference Materials (NTRM)
  - Gas Manufacturer's Intermediate Standards (GMIS)
  - Praxair Primary Laboratory Standards (PPLS)

- **Ongoing Inter-Laboratory Quality Assurance Evaluation Programs**
  - Performed Quarterly

Praxair's North American Specialty Gas Facilities are staffed with chemists and engineers trained in the preparation and analytical certification of specialty gas mixtures.

A knowledgeable sales and technical support team is ready to assist you in determining and specifying all your specialty gas needs including: high purity gases, calibration mixtures and the correct delivery equipment.

Manufacturing And Quality Control

Producing quality gas mixtures begins with proper cylinder selection and preparation to ensure high quality and enhanced stability. Outlets are selected according to Compressed Gas Association (CGA) guidelines.

The manufacture and certification of all Praxair specialty gases are documented in a comprehensive quality assurance manual. Where appropriate, traceability will be established to Praxair Primary Laboratory Standards or to NIST Traceable Standards. All processes, procedures, analytical methods and reports are carefully documented, controlled and internally assessed by Praxair Q.C./Q.A. Officers.

Documentation

Certification:

Certificate of Compliance (COC1)
Document that delineates that a product meets or exceeds the minimum purity or analytical accuracy as specified.

Certificate of Conformance (COC2)
Statement of guarantee that the product from a specific batch conforms to the components, minimum purity and maximum impurity specifications as listed.

Certificate of Analysis (COA)
A document that reports the actual analytical test results for pure product or for a calibration mixture. Either single cylinder or batch analysis certification is available.

Available Upon Request

Mixture – Safety and Quality

Safety and quality considerations limit the mixtures we can offer – among these are:

- **Fuel – Oxidizer Mixtures**
  Praxair will complete a safety review for any mixtures containing flammable and oxidizing components. Each mixture is evaluated to ensure the flammable concentration is well below the flammable limits. Praxair will determine if the mixture must be made at reduced pressure. Final mixture pressures are based on BTU calculations.

- **Vapor Pressure Restrictions**
  Mixtures containing low vapor pressure components are generally made at reduced pressures. Pressure reduction helps prevent condensation of less volatile component and ensures mixture homogeneity. Computer modeling is used to generate phase envelopes for mixture evaluation and determination of appropriate pressures.

  Where applicable, Praxair may recommend low-pressure containers to maximize the volume of contents. Refer to page A•12 for details.

- **Reactive Gas Mixtures**
  Mixture stability is assessed to help ensure the requested components do not react with each other or with the cylinder. Primary consideration is given to safety and the potential by-products created by a chemical reaction. Integrity of analytical accuracy is also evaluated. A feasibility review is peformed prior to mixture preparation.

  Where applicable, Praxair will provide aluminum or specially treated cylinders for low concentration reactive gas mixtures. See page A•11 for details on aluminum cylinders.

  The stability of certain gas mixtures can be affected by the length of time they are stored, as well as the storage temperature. To ensure the integrity of gas mixtures, storage time and temperature for susceptible mixtures should be monitored.

Mixture Grades and Specifications

Praxair mixtures are grouped into two basic categories, environmental and standard. Please refer to the table on page C·92 for complete specifications of all available grades.

Environmental Grades have been developed to meet the stringent requirements of specific environmental applications such as EPA Protocols, I&M (Inspection and Maintenance) emission standards, and mixtures requiring NIST Traceability. In all cases, specifications have been developed to meet industry standards or, in some cases, to meet regulatory requirements.

When EPA Protocols are not necessary, but NIST traceability is desired, Praxair's Master grades provide the highest degree of accuracy and confidence for your most demanding applications. These mixtures are prepared gravimetrically on high-precision, electronic balances or using dynamic blenders.

The accuracy from these methods may exceed the accuracy of most analytical instruments. Praxair produces three grades within the Master grade category; Primary, Certified, and Dynamic-Blend. The minor component(s) are analyzed and certified by Praxair and are traceable to NIST reference material.

For general purposes, Praxair's **Standard Grades** are available as Primary and Certified. These analyzed standards are typically used for high volume applications where the blending precision and accuracy of the Master grade is not required. Standard grade mixtures are prepared using gravimetric, volumetric, or partial pressure methods. As in the Master grades, the minor component(s) are analyzed and certified. The more economical Non-Certified grade is suitable for applications that do not require analytical certification.

If your requirements call for specifications that fall outside of these defined grades, a custom standard will include the exact specifications you need.

If you are uncertain about which grade to choose, Praxair technical support staff can provide recommendations based on specific applications and requirements. Call your Praxair representative or your nearest customer service location for assistance!

Contact the North America Technical Support Center at 877-PRAXAIR for assistance!

Mixture Selection Guide

Praxair offers flexibility in supplying customized gas mixtures for medical, industrial and scientific applications. Praxair is committed to safely producing stable, accurate mixtures. We produce mixtures from two to 50 or more components and apply all safety and quality considerations gleaned through decades of experience in mixture production.

To simplify the ordering process, Praxair has detailed the most common and popular mixtures in "Gases for Special Applications", which is the next section of this catalog. For your ordering convenience, please refer to the following summary of common mixtures offered in section D. See pages C•95 and C•96.

Commonly Used Cylinders for Mixtures

Type	Cylinder Sizes
Non-Reactive	K
Reactive	AS
Liquid Blends	FX LP5 Piston Cylinder (1000cc)

See pages A•9 - A•13 for other cylinder options.

Mixture Selection Guide – Summary of Mixtures in Section D

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Mixture Selection Guide – Summary of Mixtures in Section D

Minor Mixture Components

Mixture Selection Guide – Summary of Mixtures in Section D

Acetates (Esters)
Acids
Alcohols
Aldehydes
Alkanes
Alkynes
Amines
Aromatics
Bicyclics
Boranes
Carbonyls
Cyanates
Dienes
Ethers
Glycols
Halogenated Aliphatics
Halogenated Aromatics
Halogenated Olefins
Halogens
Ketones
Mercaptans (Thiols)
Metal Hydrides
Nitriles
Nitro Compounds
Nonmetal Hydrides
Olefins (Alkenes)
Organometalics
Oxides
Oxyhalides
Permanent Gases
Phenols
Pyridines
Silanes
Silicon Halides
Sulfides
Sulfones
Sulfur Bearing
Thiophenes

Common Minor Components in Specialty Mixtures

Praxair's mixture blending capabilities are among the most extensive in the industry. We can blend hundreds of minor components in a variety of balance gases in concentrations from < 1 ppm to > 50%.

The following section contains information for binary mixtures of the most common minor components, such as:

Acetylene
Ammonia
Argon
Benzene
n-Butane
Carbon Dioxide
Carbon Monoxide
Carbonyl Sulfide
Dimethyl Disulfide
Dimethyl Sulfide
Ethane
Ethanol
Ethylene
Ethylene Oxide
Halocarbon-14
Halocarbon-22
Helium
Hexane
Hydrogen
Hydrogen Sulfide
Isobutane
Isobutylene
Krypton
Methane
Methanol
Neon
Nitric Oxide
Nitrogen
Nitrogen Dioxide
Nitrous Oxide
Oxygen
Pentane
Propane
Propylene
Sulfur Dioxide
Sulfur Hexafluoride
Toluene
Vinyl Chloride
Xenon

If your required component is not listed here, please contact your Praxair representative for a custom quotation.

How to Create Your Praxair Mixtures in 3 Easy Steps

1

List minor component(s), desired concentration (e.g. ppm, vol%) and specify the desired balance gas.

2

Specify desired mixture grade to meet your specific requirements. Blend tolerance and analytical uncertainty can be specified using Custom Standard. See page C•92 for details.

3

Specify desired cylinder style. For first time mixture orders, consult Praxair for the cylinder style best suited for your volume and quality needs.

To simplify reordering, Praxair can create a custom part number for you that specifies all elements of your mixture.

Example

1		2	3
Carbon Dioxide	1200 ppm	Primary Standard	K
Oxygen	1.0%		
Nitrogen	Balance		

Balance Gas	(M)SDS Range	(M)SDS
Nitrogen	1.0 - 3.2%	P-18-0450
	3.21 - 5.0%	P-18-0451-B

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades* E	N	M	P	C	U	Cylinder Style	Pressure psig	Contents ft³	m³
Nitrogen	1 - 9999 ppm	350				•	•	•	AS	2000	143	4.0
						•	•	•	AQ	2200	82	2.3
						•	•	•	A3	2200	31	0.9
						•	•	•	K	2000	209	5.9
						•	•	•	Q	2000	70	2.0
						•	•	•	G	2000	35	1.0
	1 - 5% (1)	350				•	•	•	AS	2000	142	4.0
						•	•	•	K	2000	209	5.9
		510				•	•	•	FX	240	66	1.9

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Ammonia

Balance Gas	(M)SDS Range	(M)SDS
Air	5 ppm - 6%	P-18-0141
Helium	5 ppm - 11.4%	P-18-0139-A
Nitrogen	5 ppm - 10%	P-18-0140

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-000	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	5 ppm - 8% (1)	705				•	•	•	AS	2000	146	4.1
						•	•	•	AQ	2200	84	2.4
	L.E.L. 16%					•	•	•	A3	2200	32	0.9
Helium	5 ppm - 10% (1)	705				•	•	•	AS	2000	146	4.1
						•	•	•	AQ	2200	84	2.4
						•	•	•	A3	2200	32	0.9
Nitrogen	5 ppm - 10% (1)	705				•	•	•	AS	2000	146	4.1
						•	•	•	AQ	2200	84	2.4
						•	•	•	A3	2200	32	0.9

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Argon

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Balance Gas	(M)SDS Range	(M)SDS
Helium	1 ppm - 49%	P-18-0008-A[1]
Hydrogen	5 ppm - 49%	P-18-0009[1]
Nitrogen	1 ppm - 49%	P-18-0007-A[1]

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Helium	1 ppm - 50%	580				•	•	•	AS	2000	146	4.1
						•	•	•	AQ	2200	84	2.4
						•	•	•	A3	2200	32	0.9
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Hydrogen	1 ppm - 50%	350				•	•	•	AS	2000	146	4.1
						•	•	•	AQ	2200	84	2.4
						•	•	•	A3	2200	32	0.9
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	1 ppm - 50%	580				•	•	•	AS	2000	146	4.1
						•	•	•	AQ	2200	84	2.4
						•	•	•	A3	2200	32	0.9
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96

[1] For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Helium in Argon).

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Benzene

Balance Gas	(M)SDS Range	(M)SDS
Air	1 - 1000 ppm	P-18-0082
Nitrogen	10 ppb - 1000 ppm	P-18-0119

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	5 ppb - 1000 ppm (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
Nitrogen	5 ppb - 1000 ppm (1)	350				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Butane

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 - 9500 ppm	P-18-0090-A
Helium	0.5 ppm - 3.8%	P-18-0134-B
	3.81 - 50%	P-18-0452-A
Nitrogen	1 ppm - 4.6%	P-18-0076-A
	5.61 - 50%	P-18-0453

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.5 - 9500 ppm[1]	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.40
	L.E.L. 1.9%					•	•	•	A3	2200	32	0.90
Helium	0.5 ppm - 50%[1]	350				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	0.5 ppm - 50%[1]	350				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96

[1] Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Carbon Dioxide

Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 50%	P-18-0012-A
Argon	1 ppm - 25%	P-18-0332
Helium	1 ppm - 50%	P-18-1641
Hydrogen	1 ppm - 20%	P-18-0102-A
Nitrogen	0.01 ppm - 50%	P-18-0156-C

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.5 ppm - 50% (1)(2)	590	•	•	•	•	•	•	AS	2000	146	4.10
			•	•	•	•	•	•	AQ	2200	84	2.40
			•	•	•	•	•	•	A3	2200	32	0.90
			•	•	•	•	•	•	K	2000	199	5.64
			•	•	•	•	•	•	Q	2000	67	1.90
			•	•	•	•	•	•	G	2000	34	0.96
Argon	0.5 ppm - 50% (1)	580				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Helium	0.5 ppm - 50% (1)	580				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Hydrogen	0.5 ppm - 50% (1)	350				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	0.5 ppm - 50% (1)(2)	580	•	•	•	•	•	•	AS	2000	146	4.10
			•	•	•	•	•	•	AQ	2200	84	2.40
			•	•	•	•	•	•	A3	2200	32	0.90
			•	•	•	•	•	•	K	2000	199	5.64
			•	•	•	•	•	•	Q	2000	67	1.90
			•	•	•	•	•	•	G	2000	34	0.96

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

(2) Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Carbon Monoxide

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Balance Gases	(M)SDS Range	(M)SDS[1]
Air	1 ppm - 10%	P-18-0016-C
Argon	0.5 ppm - 11.1%	P-18-0073-A
	11.2 - 50%	P-18-0454
Helium	1 ppb - 14.3%	P-18-0074-B
	14.31 - 50%	P-18-0455-A
Hydrogen	1 ppm - 50%	P-18-0933
Nitrogen	0.5 ppm - 20%	P-18-0160-B
	20.1 - 50%	P-18-0456

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades* E	N	M	P	C	U	Cylinder Style	Pressure psig	Contents ft³	Contents m³
Air	0.5 ppm - 50%[1][2]	590	•	•	•	•	•	•	AS	2000	146	4.10
			•	•	•	•	•	•	AQ	2200	84	2.40
			•	•	•	•	•	•	A3	2200	32	0.90
			•	•	•	•	•	•	K	2000	199	5.64
			•	•	•	•	•	•	Q	2000	67	1.90
			•	•	•	•	•	•	G	2000	34	0.96
Argon	0.5 ppm - 50%[1]	350				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Helium	0.5 ppm - 50%[1]	350				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Hydrogen	0.5 ppm - 50%[1]	350				•	•	•	AS	2000	146	4.10
						•	•	•	AQ	2200	84	2.40
						•	•	•	A3	2200	32	0.90
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	0.5 ppm - 50%[1][2]	350	•	•	•	•	•	•	AS	2000	146	4.10
			•	•	•	•	•	•	AQ	2200	84	2.40
			•	•	•	•	•	•	A3	2200	32	0.90
			•	•	•	•	•	•	K	2000	199	5.64
			•	•	•	•	•	•	Q	2000	67	1.90
			•	•	•	•	•	•	G	2000	34	0.96

[1] Cylinder pressure and contents will vary proportionately at higher concentrations.

[2] Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Carbonyl Sulfide

Balance Gas	(M)SDS Range	(M)SDS
Helium	0.1 ppm - 3%	P-18-0071
Nitrogen	0.1 ppb - 1%	P-18-0064-A

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-000	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Helium	95 ppb - 5000 ppm	330				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	95 ppb - 5000 ppm	330				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Dimethyl Disulfide

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Balance Gases	(M)SDS Range	(M)SDS
Helium	0.5 - 2000 ppm	P-18-0457
Nitrogen	0.5 - 2000 ppm	P-18-0458

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-000	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Helium	0.1 ppm - 5%	330				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	0.1 ppm - 5%	330				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Dimethyl Sulfide

Balance Gases	(M)SDS Range	(M)SDS
Helium	0.1 - 1000 ppm	P-18-0062
Nitrogen	0.1 - 999 ppm	P-18-0066

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-000	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Helium	100 ppb - 5000 ppm	330				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	100 ppb - 5000 ppm	330				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Ethane

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 1.5%	P-18-0093
Helium	1 ppm - 8.4%	P-18-0112
	8.41 - 49.9%	P-18-0130
Nitrogen	1 ppm -12%	P-18-0099
	12.1 - 50%	P-18-0459

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 ppm - 1.5% (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	K	2000	215	6.09
	L.E.L. 3.0%					•	•	•	Q	2000	72	2.04
Helium	1 ppm - 50% (1)	350				•	•	•	AS	2000	134	3.79
						•	•	•	K	2000	198	5.61
						•	•	•	Q	2000	66	1.87
Nitrogen	1 ppm - 50% (1)	350				•	•	•	AS	2000	149	4.22
						•	•	•	K	2000	221	6.26
						•	•	•	Q	2000	74	2.10

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Ethanol

Balance Gas	(M)SDS Range	(M)SDS
Air	1 - 1000 ppm	P-18-0460-A
Helium	1 - 1000 ppm	P-18-0461
Nitrogen	1 - 950 ppm	P-18-0095-A

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 - 1000 ppm (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
Helium	1 - 1000 ppm (1)	350				•	•	•	AS	2000	134	3.79
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
Nitrogen	1 - 1000 ppm (1)	350				•	•	•	AS	2000	149	4.22
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Ethylene

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 1.4%	P-18-0094-A
Helium	1 ppm - 4.1%	P-18-0109
	4.2 - 20%	P-18-0132-A
Nitrogen	1 ppm - 6%	P-18-0462
	6.1 - 50%	P-18-0463

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 ppm - 1.35% (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	K	2000	215	6.09
	L.E.L. 2.7%					•	•	•	Q	2000	72	2.04
Helium	0.1 ppm - 50% (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	66	1.87
Nitrogen	0.1 ppm - 50% (1)	350				•	•	•	AS	2000	145	4.11
						•	•	•	K	2000	214	6.06
						•	•	•	Q	2000	71	2.01

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Ethylene Oxide

Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 1.5%	P-18-0464-A
Nitrogen	1 ppm - 3.7%	P-18-0100-B
	3.71 - 49.9%	P-18-0545

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 ppm - 1.50% (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
	L.E.L. 3.0%					•	•	•	A3	2200	32	0.91
Nitrogen	1 ppm - 20% (1)	350				•	•	•	AS	2000	143	4.05
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Halocarbon 14

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 1%	P-18-1021
Nitrogen	1 ppm - 1%	P-18-1022

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.2 ppm - 99.9%	590				•	•	•	K	2000	215	6.09
						•	•	•	Q	2000	72	2.04
						•	•	•	G	2000	36	1.02
Nitrogen	0.2 ppm - 99.9%	580				•	•	•	AS	2000	209	5.92
						•	•	•	K	2000	70	1.98
						•	•	•	Q	2000	36	1.02

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Helium

Balance Gas	(M)SDS Range	(M)SDS
Argon	1 ppm - 49%	P-18-0345-A[1]
Nitrogen	1 ppm - 49%	P-18-0124-A[1]

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Argon	200 ppm - 99.9%	580				•	•	•	AS	2000	153	4.33
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Nitrogen	200 ppm - 99.9%	580				•	•	•	AS	2000	142	4.02
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	Q	2000	35	0.99

[1] For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Helium in Argon).

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**,
Certified Standard **(C)**, Non-Certified Standard **(U)**

Hexane

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 - 5000 ppm	P-18-0088
Helium	10 ppb - 5000 ppm	P-18-0397
Nitrogen	10 ppb - 5000 ppm	P-18-0122

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.25 - 5000 ppm (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
	L.E.L. 1.1%					•	•	•	A3	2200	32	0.91
Helium	0.25 - 5000 ppm (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	0.25 - 5000 ppm (1)	350				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Hydrogen

Balance Gas	(M)SDS Range	(M)SDS
Air	5 ppm - 3.2 %	P-18-0015-C
Argon	1 ppm - 2.9%	P-18-0331-B
	2.91 - 49.9%	P-18-0337-A(1)
Helium	1 ppm - 3.9%	P-18-0113-A
	3.91 - 49.9%	P-18-0125-A(1)
Nitrogen	1 ppm - 5.7%	P-18-0111
	5.8 - 49.9%	P-18-0250-A(1)

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents ft³	Contents m³
			E	N	M	P	C	U				
Air	1 ppm - 2.0%	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
						•	•	•	K	2000	215	6.09
						•	•	•	Q	2000	72	2.04
	L.E.L. 4.0%					•	•	•	G	2000	36	1.02
Argon	1 ppm - 99.9%	350				•	•	•	AS	2000	153	4.33
						•	•	•	AQ	2200	89	2.52
						•	•	•	A3	2200	33	0.93
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	Q	2000	38	1.08
Helium	1 ppm - 99.9%	350				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	Q	2000	34	0.96
Nitrogen	1 ppm - 99.9%	350				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	Q	2000	35	0.99

(1) For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Argon in Hydrogen).

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Hydrogen Sulfide

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Balance Gas	(M)SDS Range	(M)SDS
Air	5 - 1000 ppm	P-18-0135-A
Helium	0.1 ppm - 4.6%	P-18-0068-A
	4.7 - 10%	P-18-0468
Hydrogen	1 ppm - 10%	P-18-0333
Methane	1 ppm - 3%	P-18-0123-B
Nitrogen	1 ppm - 6.7%	P-18-0105-A
	6.71 - 14.23%	P-18-0469-A

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-000	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.2 ppm - 2.15% [1]	330	•	•	•	•	•	•	AS	2000	146	4.13
			•	•	•	•	•	•	AQ	2200	84	2.38
	L.E.L. 4.3%		•	•	•	•	•	•	A3	2200	32	0.91
Helium	0.2 ppm - 50%	330				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Hydrogen	0.2 ppm - 50%	330				•	•	•	AS	2000	133	3.77
						•	•	•	AQ	2200	77	2.18
						•	•	•	A3	2200	29	0.82
Methane	0.2 ppm - 50%	330				•	•	•	AS	2000	173	4.90
						•	•	•	AQ	2200	100	2.83
						•	•	•	A3	2200	38	1.08
Nitrogen	0.2 ppm - 50% [1][2]	330	•	•	•	•	•	•	AS	2000	209	5.92
			•	•	•	•	•	•	AQ	2200	70	1.98
			•	•	•	•	•	•	A3	2200	35	0.99

[1] Available concentrations for NIST traceable mixtures to be determined by available reference materials.

[2] Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Isobutane

Balance Gas	(M)SDS Range	(M)SDS
Air	1 - 6000 ppm	P-18-0089
Helium	1 ppm - 1%	P-18-0096
Nitrogen	1.9 - 10%	P-18-0114-A

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades* E	N	M	P	C	U	Cylinder Style	Pressure psig	Contents ft^3	m^3
Air	0.5 - 5000 ppm (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	K	2000	215	6.09
	L.E.L. 1.8%					•	•	•	Q	2000	72	2.04
Helium	1 ppm - 99.9% (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
Nitrogen	1 ppm - 99.9% (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Isobutylene

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 - 6000 ppm	P-18-0357
Helium	1 - 5000 ppm	P-18-0471
Nitrogen	1 - 5000 ppm	P-18-0472

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.5 - 5000 ppm (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	K	2000	215	6.09
	L.E.L. 1.8%					•	•	•	Q	2000	72	2.04
Helium	0.5 - 5000 ppm (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
Nitrogen	0.5 - 5000 ppm (1)	350				•	•	•	AS	2000	142	4.02
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Krypton

Balance Gases	(M)SDS Range	(M)SDS
Argon	1 ppm - 50%	P-18-0473-A[1]
Helium	1 ppm - 50%	P-18-0474-A[1]
Nitrogen	1 ppm - 50%	P-18-0475-A[1]

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Argon	50 ppm - 99.9%	580				•	•	•	AS	2000	153	4.33
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	50 ppm - 99.9%	580				•	•	•	AS	2000	137	3.88
						•	•	•	K	2000	203	5.75
						•	•	•	Q	2000	68	1.93
						•	•	•	G	2000	34	0.96
Nitrogen	50 ppm - 99.9%	580				•	•	•	AS	2000	142	4.02
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	G	2000	35	0.99

[1] For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Argon in Krypton).

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Methane

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Balance Gases	(M)SDS Range	(M)SDS
Air	1 ppm - 2.5%	P-18-0101
Argon	0.1 ppm - 10%	P-18-0097-B
	10.1 - 50%	P-18-0128-A
Helium	1 ppm - 10.1%	P-18-0098-A
	10.2 - 49.9%	P-18-0129-A
Hydrogen	1 ppm - 50%	P-18-0116
Nitrogen	0.1 ppm - 14.3%	P-18-0110-B
	14.31 - 49.9%	P-18-0506

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.1 ppm - 2.5% [1][2]	590	•	•	•	•	•	•	AS	2000	146	4.10
			•	•	•	•	•	•	AQ	2200	84	2.40
			•	•	•	•	•	•	A3	2200	32	0.90
			•	•	•	•	•	•	K	2000	215	6.09
			•	•	•	•	•	•	Q	2000	72	2.04
	L.E.L. 5%		•	•	•	•	•	•	G	2000	36	1.02
Argon	0.1 ppm - 50% [1]	350				•	•	•	AS	2000	153	4.33
						•	•	•	AQ	2200	89	2.52
						•	•	•	A3	2200	33	0.93
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	0.1 ppm - 50% [1]	350				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Hydrogen	0.1 ppm - 50% [1]	350				•	•	•	AS	2000	133	4.10
						•	•	•	AQ	2200	77	2.40
						•	•	•	A3	2200	29	0.90
						•	•	•	K	2000	196	5.55
						•	•	•	Q	2000	65	1.84
						•	•	•	G	2000	33	0.94
Nitrogen	0.1 ppm - 50% [1][2]	350	•	•	•	•	•	•	AS	2000	142	4.02
			•	•	•	•	•	•	AQ	2200	82	2.32
			•	•	•	•	•	•	A3	2200	31	0.88
			•	•	•	•	•	•	K	2000	209	5.92
			•	•	•	•	•	•	Q	2000	70	1.98
			•	•	•	•	•	•	G	2000	36	1.02

[1] For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Argon in Methane).

[2] Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Methanol

Balance Gas	(M)SDS Range	(M)SDS
Air	0.05 - 5000 ppm	P-18-0476
Helium	0.05 - 5000 ppm	P-18-0477
Nitrogen	1 ppm - 1%	P-18-0083-A

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 - 5000 ppm (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
Helium	1 - 5000 ppm (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	78	2.21
						•	•	•	Q	2000	29	0.82
Nitrogen	1 - 5000 ppm (1)	350				•	•	•	AS	2000	142	4.02
						•	•	•	K	2000	82	2.32
						•	•	•	Q	2000	31	0.88

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Neon

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Balance Gas	(M)SDS Range	(M)SDS
Argon	1 ppm - 50%[1]	P-18-0478-A
Helium	1 ppm - 50%[1]	P-18-0039-B
Nitrogen	1 ppm - 50%[1]	P-18-0479-A

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Argon	1 ppm - 99.9%	580				•	•	•	AS	2000	153	4.33
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	1 ppm - 99.9%	580				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	1 ppm - 99.9%	580				•	•	•	AS	2000	142	4.02
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	G	2000	35	0.99

[1] For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Argon in Neon).

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Nitric Oxide

Balance Gas	(M)SDS Range	(M)SDS
Helium	0.1 ppm - 2.29%	P-18-0375
	2.4 - 3.83%	P-18-0480
Nitrogen	0.1 ppm - 2.29%	P-18-0070-A
	3.84 - 11.49%	P-18-0429-A

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-000	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents ft³	Contents m³
			E	N	M	P	C	U				
Helium	2.5 ppm - 5%	660				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	2.5 ppm - 5% (1)	660	•	•	•	•	•	•	AS	2000	143	4.05
			•	•	•	•	•	•	AQ	2200	82	2.32
			•	•	•	•	•	•	A3	2200	31	0.88

(1) Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Balance Gas	(M)SDS Range	(M)SDS
Argon	1 ppm - 49.9%(1)	P-18-0335-C
Helium	1 ppm - 49.9%(1)	P-18-0127-B
Hydrogen	1 ppm - 49.9%(1)	P-18-0432
Oxygen	0.1 ppm - 49.9%(1)	P-18-0434-A

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents ft³	Contents m³
			E	N	M	P	C	U				
Argon	1 ppm - 99.9%	580				•	•	•	AS	2000	153	4.33
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	1 ppm - 99.9%	580				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Hydrogen	1 ppm - 99.9%	350				•	•	•	AS	2000	133	3.77
						•	•	•	K	2000	196	5.55
						•	•	•	Q	2000	65	1.84
						•	•	•	G	2000	33	0.93
Oxygen	1 ppm - 99.9%	296				•	•	•	AS	2000	153	4.33
						•	•	•	K	2000	226	2.52
						•	•	•	Q	2000	76	2.15
						•	•	•	G	2000	38	1.08

(1) For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Oxygen in Nitrogen).

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Nitrogen Dioxide

Balance Gas	(M)SDS Range	(M)SDS
Air	0.1 ppm - 0.5%	P-18-0067
Nitrogen	0.1 ppm - 0.5975%	P-18-0370-B
	0.5876 - 1%	P-18-0871-A

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-CGA	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	2 ppm - 1% (1)	660	•	•	•	•	•	•	AS	2000	144	4.08
			•	•	•	•	•	•	AQ	2200	83	2.35
			•	•	•	•	•	•	A3	2200	31	0.88
Nitrogen	2 ppm - 1%	660				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

(1) Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Nitrous Oxide

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 1%	P-18-0032
Argon	1 ppm - 39.1%	P-18-0481
	39.2 - 50%	P-18-0482
Helium	0.1 ppm - 10%	P-18-0374
	39.2 - 50%	P-18-0483
Nitrogen	0.1 ppm - 39.1%	P-18-0290-A
	39.2 - 50%	P-18-0484

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 ppm - 50%	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
						•	•	•	K	2000	215	6.09
						•	•	•	Q	2000	72	2.04
						•	•	•	G	2000	36	1.02
Argon	1 ppm - 50%	590				•	•	•	AS	2000	153	4.33
						•	•	•	AQ	2200	89	2.29
						•	•	•	A3	2200	33	0.85
						•	•	•	K	2000	226	6.37
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	1 ppm - 50%	590				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
						•	•	•	K	2000	199	5.6
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	1 ppm - 50%	590				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	G	2000	35	0.99

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Oxygen

Balance Gas	(M)SDS Range	(M)SDS
Argon	1 ppm - 23.4%	P-18-0285-B
	23.6 - 49%(1)	P-18-0131
Helium	1 ppm - 23.5%	P-18-0010-B
	23.6 - 50%(1)	P-18-0014-A
Nitrogen	1 ppm - 23.5%(1)	P-18-0153-B
	23.6 - 49%(1)	P-18-0011-A

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft³	m³
Argon	0.5 ppm - 5%(2)	580				•	•	•	AS	2000	153	4.33
	5.01 - 23.5%(2)	590				•	•	•	AQ	2200	89	2.52
	23.6 - 99.9%(2)	296				•	•	•	A3	2200	33	0.93
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	0.5 ppm - 5%(2)	580				•	•	•	AS	2000	135	3.82
	5.01 - 23.5%(2)	590				•	•	•	AQ	2200	78	2.21
	23.6 - 99.9%(2)	296				•	•	•	A3	2200	29	0.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	0.5 ppm - 5%(2)	580	•	•	•	•	•	•	AS	2000	142	4.02
	5.01 - 23.5%(2)	590	•	•	•	•	•	•	AQ	2200	78	2.21
	23.6 - 99.9%(2)	296	•	•	•	•	•	•	A3	2200	29	0.82
			•	•	•	•	•	•	K	2000	199	5.64
			•	•	•	•	•	•	Q	2000	67	1.90
			•	•	•	•	•	•	G	2000	34	0.96

(1) For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Argon in Oxygen).

(2) Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**,
Certified Standard **(C)**, Non-Certified Standard **(U)**

Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 0.75%	P-18-0033
Nitrogen	1 ppm - 1%	P-18-0485

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 - 7500 ppm	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
						•	•	•	K	2000	215	6.09
						•	•	•	Q	2000	72	2.04
	L.E.L. 1.5%					•	•	•	G	2000	36	1.02
Nitrogen	1 ppm - 1%	350				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	G	2000	35	0.99

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Propane

Balance Gas	(M)SDS Range	(M)SDS
Air	1 ppm - 1.65%	P-18-0091-A
Helium	1 ppm - 4.5%	P-18-0106-A
	4.46 - 50%	P-18-0486
Nitrogen	1 ppm - 6.5%	P-18-0270-B
	6.6 - 50%	P-18-0487

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.1 ppm - 1.05% [2]	590	•	•	•	•	•	•	AS	2000	146	4.13
			•	•	•	•	•	•	AQ	2200	84	2.38
			•	•	•	•	•	•	A3	2200	32	0.91
			•	•	•	•	•	•	K	2000	215	6.09
			•	•	•	•	•	•	Q	2000	72	2.04
	L.E.L. 2.1%		•	•	•	•	•	•	G	2000	36	1.02
Helium	0.1 ppm - 50% [1]	350				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	0.1 ppm - 50% [1][2]	350	•	•	•	•	•	•	AS	2000	142	4.02
			•	•	•	•	•	•	AQ	2200	82	2.32
			•	•	•	•	•	•	A3	2200	31	0.88
			•	•	•	•	•	•	K	2000	209	5.92
			•	•	•	•	•	•	Q	2000	70	1.98
			•	•	•	•	•	•	G	2000	35	0.99

[1] Cylinder pressure and contents will vary proportionately at higher concentrations.

[2] Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Propylene

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Balance Gas	(M)SDS Range	(M)SDS
Air	1 - 6000 ppm	P-18-0092
Helium	1 ppm - 2.9%	P-18-0107-A
Nitrogen	1 ppm - 5.6%	P-18-0108-A
	5.7 - 50%	P-18-0489

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents ft³	Contents m³
			E	N	M	P	C	U				
Air	0.5 ppm - 1%	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
						•	•	•	K	2000	215	6.09
						•	•	•	Q	2000	72	2.04
	L.E.L. 2.0%					•	•	•	G	2000	36	1.02
Helium	0.5 ppm - 50% (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	0.5 ppm - 50% (1)	350				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	G	2000	35	0.99

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Sulfur Dioxide

Balance Gas	(M)SDS Range	(M)SDS
Air	0.1 ppm - 8%	P-18-0059-A
Helium	0.2 ppm - 1%	P-18-0072
Nitrogen	1 ppm - 20%	P-18-0208-A

Regulator Recommendations		Page
Single Stage	PRS40223331-CGA	E•248
Two Stage	PRS40323331-CGA	E•247
Line	PRS40252001-000	E•249

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	1 ppm - 20%	660				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
Helium	1 ppm - 20%	660				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	1 ppm - 20% (1)	660	•	•	•	•	•	•	AS	2000	142	4.02
			•	•	•	•	•	•	AQ	2200	82	2.32
			•	•	•	•	•	•	A3	2200	31	0.88

(1) Available concentrations for NIST traceable mixtures to be determined by available reference materials.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Sulfur Hexafluoride

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Balance Gas	(M)SDS Range	(M)SDS
Air	10 ppb - 1%	P-18-0117
Argon	1 ppm - 50%	P-18-0490
Helium	1 ppm - 50%	P-18-0491
Nitrogen	10 ppb - 50%	P-18-0118-A

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents ft³	Contents m³
			E	N	M	P	C	U				
Air	10 ppb - 50%	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
						•	•	•	K	2000	215	6.09
						•	•	•	Q	2000	72	2.04
						•	•	•	G	2000	36	1.02
Argon	10 ppb - 50%	580				•	•	•	AS	2000	153	4.33
						•	•	•	AQ	2200	89	2.52
						•	•	•	A3	2200	33	0.93
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	10 ppb - 50%	580				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	10 ppb - 50%	580				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88
						•	•	•	K	2000	209	5.92
						•	•	•	Q	2000	70	1.98
						•	•	•	G	2000	35	0.99

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Toluene

Balance Gases	(M)SDS Range	(M)SDS
Air	1 - 6000 ppm	P-18-0084
Helium	1 - 1000 ppm	P-18-0492
Nitrogen	10 ppb - 1%	P-18-0121-B

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.02 - 1000 ppm (1)	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
Helium	0.02 - 1000 ppm (1)	350				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	0.02 - 1000 ppm (1)	350				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

(1) Cylinder pressure and contents will vary proportionately at higher concentrations.

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Vinyl Chloride

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Balance Gases	(M)SDS Range	(M)SDS
Air	1 - 3000 ppm	P-18-0075
Helium	1 - 1000 ppm	P-18-0493
Nitrogen	10 ppb - 2000 ppm	P-18-0120

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades*						Cylinder Style	Pressure psig	Contents	
			E	N	M	P	C	U			ft^3	m^3
Air	0.2 - 1000 ppm	590				•	•	•	AS	2000	146	4.13
						•	•	•	AQ	2200	84	2.38
						•	•	•	A3	2200	32	0.91
Helium	0.2 - 1000 ppm	350				•	•	•	AS	2000	135	3.82
						•	•	•	AQ	2200	78	2.21
						•	•	•	A3	2200	29	0.82
Nitrogen	0.2 - 1000 ppm	350				•	•	•	AS	2000	142	4.02
						•	•	•	AQ	2200	82	2.32
						•	•	•	A3	2200	31	0.88

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Xenon

Balance Gases	(M)SDS Range	(M)SDS
Argon	1 ppm - 49%[1]	P-18-0494-B
Helium	1 ppm - 50%[1]	P-18-0040-C
Nitrogen	1 ppm - 50%[1]	P-18-0495-B

Regulator Recommendations		Page
Single Stage	PRS40023331-CGA	E•245
Two Stage	PRS40123331-CGA	E•244
Line	PRS40052001-000	E•246

Balance Gas	Concentration Range	CGA	Praxair Grades* E	N	M	P	C	U	Cylinder Style	Pressure psig	Contents ft^3	m^3
Argon	50 ppm - 99.9%	580				•	•	•	AS	2000	153	4.33
						•	•	•	K	2000	226	6.40
						•	•	•	Q	2000	75	2.12
						•	•	•	G	2000	38	1.08
Helium	50 ppm - 99.9%	580				•	•	•	AS	2000	135	3.82
						•	•	•	K	2000	199	5.64
						•	•	•	Q	2000	67	1.90
						•	•	•	G	2000	34	0.96
Nitrogen	50 ppm - 99.9%	580				•	•	•	AS	2000	137	3.88
						•	•	•	K	2000	203	5.75
						•	•	•	Q	2000	68	1.93
						•	•	•	G	2000	34	0.96

[1] For concentrations above 50%, the (M)SDS for the inverse mixture applies (i.e. Argon in Xenon).

* **Key for Praxair Mixture Grades** (Refer to page C•92 for complete specification details.)
EPA **(E)**, Primary Master **(PM)**, Certified Master **(CM)**, Primary Standard **(P)**, Certified Standard **(C)**, Non-Certified Standard **(U)**

Notes

Special Applications

Section

D

Special Applications

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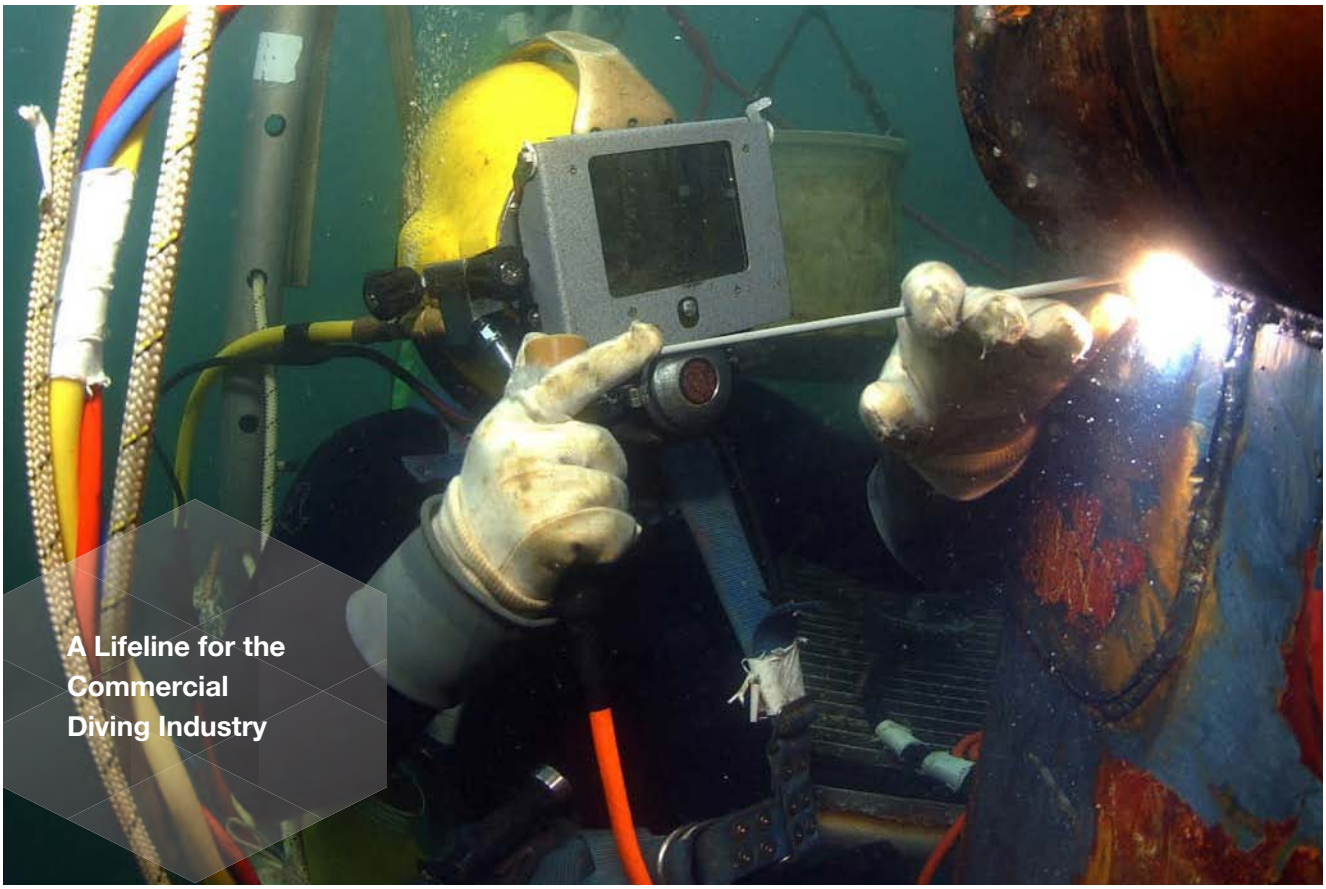
In this section

Special Applications by Industry

Diving

Overview



Praxair is a leading worldwide supplier of helium and other gases. Praxair began supplying helium/oxygen breathing mixtures for offshore oil field diving over 40 years ago.

Decades of experience, combined with a global diving gases supply and distribution network, are two key reasons why the commercial diving industry breathes easier with Praxair.

For pure helium or gas mixtures, in tube modules or in cylinder packs, Praxair has the know-how and resources to provide a reliable supply for your dive operations, today and tomorrow.

Supplying the Demand

Diving operations rely on Praxair for helium, helium/oxygen, oxygen and nitrogen/oxygen mixtures. We meet customers' needs through a wide variety of supply systems that provide our quality gases and mixtures.

Whatever gas or supply option you choose, your diving gases will be mixed to meet your specifications. Praxair operates one of the world's largest gas blenders at our Louisiana facility. This enhances the speed and accuracy of our gas-mixing operation and also provides supply gas mixtures on very short notice to offshore diving activity in the Gulf of Mexico and nearby locations.

Safety and Quality Commitment

The Praxair diving gas group operates under strict safety standards. The accuracy and purity of our gas mixtures and the safety of the diving gases equipment are one of Praxair's priorities. This helps you assure that you receive a diving gas package containing the gas percentages you request...every time.

Diving

Cylinders and Containers

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8-Tube Module

- **Average Water Volume:** 327 cf (9.26 M^3)
- **Average Gas Volume when full:** 55,061 scf (1,559 M^3)
- **Average Pressure when full:** 2,640 psig @ 70° F
- **Average Tare Weight:** 23,000 lb (10,443 kg)
- **Average Weight with He:** 23,569 lb (10,691 kg)
- **Average Weight with O_2:** 27,560 lb (12,501 kg)
- **Length:** 240 inches (6.10 meters)
- **Width:** 96 inches (2.44 meters)
- **Height:** 51 inches (1.30 meters)

25-Tube Skid

- **Average Water Volume:** 128 cf (3.62 M^3)
- **Average Gas Volume when full:** 23,120 scf (655 M^3)
- **Average Pressure when full:** 2,640 psig @ 70° F
- **Average Tare Weight:** 13,000 lb (5,897 kg)
- **Average Weight with He:** 13,239 lb (6,005 kg)
- **Average Weight with O_2:** 14,915 lb (6,765 kg)
- **Length:** 158 inches (4.01 meters)
- **Width:** 60 inches (1.52 meters)
- **Height:** 64 inches (1.63 meters)

4-Tube Module

- **Average Water Volume:** 102 cf (2.89 M^3)
- **Average Gas Volume when full:** 18,424 scf (522 M^3)
- **Average Pressure when full:** 2,640 psig @ 70° F
- **Average Tare Weight:** 8,160 lb (3,701 kg)
- **Average Weight with He:** 8,350 lb (3,787 kg)
- **Average Weight with O_2:** 9,686 lb (4,393 kg)
- **Length:** 166 inches (4.22 meters)
- **Width:** 64 inches (1.63 meters)
- **Height:** 51 inches (1.30 meters)

DOT Shipping Name/ I.D. Number
Oxygen UN1072
Helium UN1046
Nitrogen UN1066

Cylinder Style/ Water Volume
T 1.72 Cubic Feet
K 1.54 Cubic Feet
LN 1.54 Cubic Feet

Compressed Gas, N.O.S. UN1956
(balanced gas/oxygen)
Nonoxidizing mixture
(oxygen < 23.5%)

Compressed Gas Oxidizing N.O.S. UN3156
(balanced gas/oxygen)
Oxidixing mixture
(oxygen > 23.5%)

25-Cylinder Pack T-Series

- **Average Water Volume:** 43.25 cf (1.22 M^3)
- **Average Gas Volume when full:** 7,812 scf (221 M^3)
- **Average Pressure when full:** 2,640 psig @ 70° F
- **Average Tare Weight:** 5,500 lb (2,495 kg)
- **Average Weight with He:** 5,581 lb (2,531 kg)
- **Average Weight with O_2:** 6,147 lb (2,788 kg)
- **Length:** 85 inches (2.16 meters)
- **Width:** 60 inches (1.52 meters)
- **Height:** 64 inches (1.63 meters)

16-Cylinder Pack T-Series

- **Average Water Volume:** 27.68 cf (0.78 M^3)
- **Average Gas Volume when full:** 5,000 scf (142 M^3)
- **Average Pressure when full:** 2,640 psig @ 70° F
- **Average Tare Weight:** 2,800 lb (1,270 kg)
- **Average Weight with He:** 2,852 lb (1,294 kg)
- **Average Weight with O_2:** 3,214 lb (1,458 kg)
- **Length:** 36 inches (0.91 meters)
- **Width:** 36 inches (0.91 meters)
- **Height:** 88 inches (2.24 meters)

16-Cylinder Pack LN-Series

- **Average Water Volume:** 24.64 cf (0.70 M^3)
- **Average Gas Volume when full:** 4,082 scf (116 M^3)
- **Average Pressure when full:** 2,430 psig @ 70° F
- **Average Tare Weight:** 2,550 lb (1,157 kg)
- **Average Weight with He:** 2,592 lb (1,176 kg)
- **Average Weight with O_2:** 2,888 lb (1,310 kg)
- **Length:** 36 inches (0.91 meters)
- **Width:** 36 inches (0.91 meters)
- **Height:** 83 inches (2.11 meters)

16-Cylinder Pack K-Series

- **Average Water Volume:** 24.64 cf (0.70 M^3)
- **Average Gas Volume when full:** 3,713 scf (105 M^3)
- **Average Pressure when full:** 2,200 psig @ 70° F
- **Average Tare Weight:** 2,450 lb (1,111 kg)
- **Average Weight with He:** 2,488 lb (1,129 kg)
- **Average Weight with O_2:** 2,757 lb (1,251 kg)
- **Length:** 36 inches (0.91 meters)
- **Width:** 36 inches (0.91 meters)
- **Height:** 83 inches (2.11 meters)

Cylinder Floor Stand

Designed and built for the safe storage of cylinders up to 12 inches in diameter. Welded construction and epoxy power paint finish provide structural integrity.

Part Number	Description	Dimensions W x D x H	Weight lb (kg)
PRS-275	Four Cylinder Floor Stand	36.5" x 24" x 30" (93 x 61 x 76 cm)	69 (31)
PRS-375	Six Cylinder Floor Stand	48.5" x 24" x 30" (123 x 61 x 76 cm)	81 (37)
PRS-475	Eight Cylinder Floor Stand	64" x 24" x 30" (163 x 61 x 76 cm)	93 (42)

Protocol Station

Designed to provide a safe, economical way to support regulators, which helps prevent regulator damage.

Part Number	Description
PRS50290104-CGA	Protocol Station

Wall Mounted Cylinder Bracket

Government regulations require that compressed gas cylinders be secured when in storage or in use. This cast aluminum bracket, with chain restraint, provides an easy method to secure to a suitable surface.

Part Number	Description
PRS400-CH	Cylinder Wall Bracket

4096 Regulator

Praxair's 4096 Regulator is designed to deliver pressure ranges of 0-2500 psi for transfilling of inert gases or oxygen from a cylinder or bank source and can be panel mounted or ordered with a cylinder connection.

Features and Benefits

- Front and rear panel mountable and available with standard CGA's for cylinder mounting
- **Barstock Body** Smooth surface finish
- **Pressure Range** 0-2500 psig

Specifications

- **Maximum Inlet Pressure** 3000 psig
- **Gauges** 2-1/2" chrome plated brass
- **Temperature Range** -40 °F to 140 °F (-40 °C to 60 °C)
- **Weight** 5.9 lbs
- **Cv** .06
- **Ports** 1/4" NPTF

Materials

- **Seat** Vespal®
- **Seals** Buna-N
- **Body** Nickel plated brass barstock
- **Bonnet** Nickel plated brass

Ordering Information

Part Number	Outlet Pressure	Gauges	Description
PRS4096-1580	0-2500 psig	Inlet 0-3000 Outlet 0-3000	Helium and Argon Service
PRS4096-2540	0-2500 psig	Inlet 0-3000 Outlet 0-3000	Oxygen Service

Pressure Gauges

These 2-1/2" chrome-plated brass gauges allow for monitoring of pressure in system.

Part Number	Range
PRS550-0248	0-4000

Diving
Equipment

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Single Row Manifold*

Designed for centralized distribution of cylinder gases. Each system comes complete with a stainless steel flexible pigtail.

* Rated to 3,000 psi

Ordering Information – Series PRS502BABCD-CGA (Brass) and Series PRS502SABCD-GGA

A	B	C	D	CGA
Configuration	**Cylinders/Side**	**Pigtail Style**	**Outlet**	**Inlet Connections**
1: Standard Single Row (right or left extension) 2: Standard Double Row (two pigtails per station) 3: Standard Duplex (right and left extensions) 4: Compact Single Row (right or left extension) 5: Compact Double Row (two pigtails per station) 6: Compact Duplex (right and left extensions)	0: 10 cylinders 1: 1 cylinder 2: 2 cylinders 3: 3 cylinders 4: 4 cylinders 5: 5 cylinders 6: 6 cylinders 7: 7 cylinders 8: 8 cylinders 9: 9 cylinders	0: None 2: Flexible 316 Stainless Steel, 24", with Check Valve 3: Flexible 316 Stainless Steel, 36", with Check Valve 6: Flexible 316 Stainless Steel, 72", with Check Valve	1: 1/4" FPT 2: With CGA Adaptor	Please specify inlet CGA

High-Pressure Hoses

Stainless steel 316L flexible hoses are designed for flexible operation.

Ordering Information (Other sizes available upon request)

Stock Code	Description	Type	Working	Burst
PRSS33S000-36	1/4" X 36" SS Pigtail	Double Braid No Guard	4100	16,400
PRSS33S000-72	1/4" X 72" SS Pigtail	Double Braid No Guard	4100	16,400

Diaphragm and Needle Valves

Multi-turn diaphragm valves can be used for primary flow control, while the ¼-turn acts as a quick on/off valve. Needle valves are used primarily for fine flow applications.

Diaphragm Valves

Part Number	Description
PRS533099	Multi-turn chrome-plated brass 1/4" MNPT x 1/4" FNPT
PRS533199	¼-turn chrome-platerd brass 1/4" MNPT x 1/4" FNPT

Needle Valve

Part Number	Description
PRS5500067	Forged chrome-plated brass 1/4" MNPT x 1/4" MNPT

Check Valves

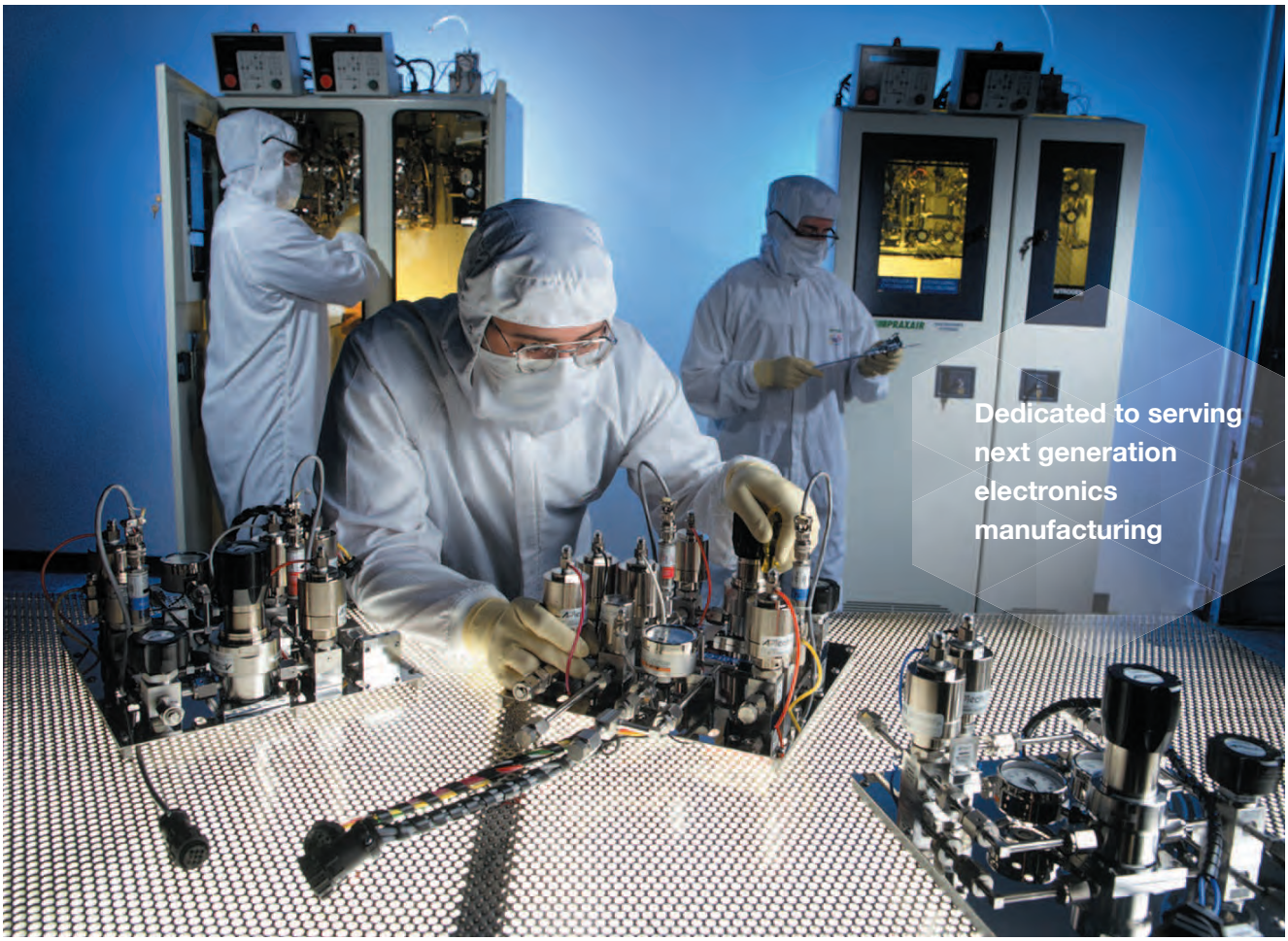
Used to ensure that gas flows in only one direction.

Ordering Information

Part Number	Maximum Operating Pressure (psig)	Cracking Pressure (psig)	Connections Inlet	Outlet	Body Material	Seal Material	Flow Coefficient (Cv)
PRSCV5651	3000	1.0	1/4" NPT male	1/4" NPT male	Brass	Viton®	0.5

Electronics

Overview



Praxair is committed to providing the electronics industry with high quality products, technology and services. Through our ISO certification and Quality Assurance Program, including statistical process control, Praxair maintains strict procedures for monitoring and controlling product quality.

Praxair's high purity process gases play a significant role in the manufacture of semiconductor devices and related electronic material development. The gases are used throughout all stages of fabrication – from the growing of single silicon crystals, through the steps of wafer fabrication, to final assembly and packaging.

Comprehensive Product Range
Supplying each application with the proper gas (grade, compliance, certification, scale).

Superior Reliability
Ensuring high quality products are there when they are needed.

Equipment and Systems Excellence
Connecting customers with everything needed to handle and store gases efficiently and safely.

Productivity and Innovation Partner
Working with laboratories production and development groups to identify and implement productivity and cost improvements.

Ease of Doing Business
Providing convenient e-commerce options and strong customer support.

Safety Focus
Making safety a top priority for every activity.

Electronics

Overview

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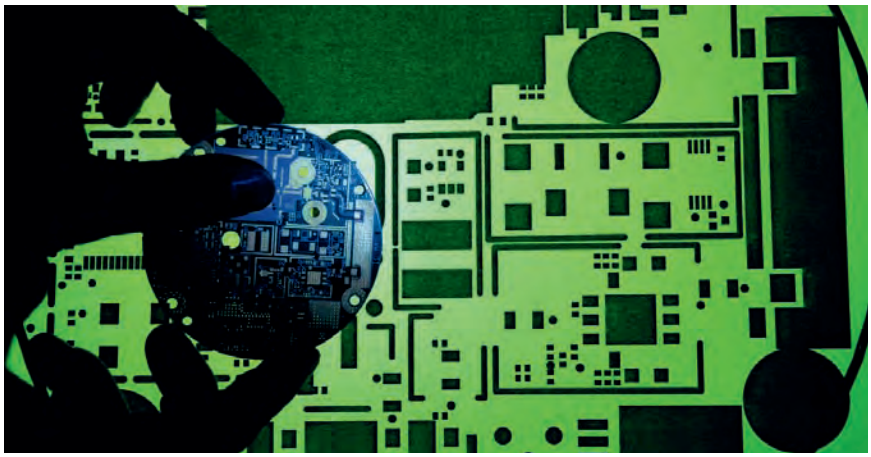


Praxair's Commitment to Safety

Praxair has an unwavering commitment to put safety first. As a cornerstone of our corporate culture, Praxair closely monitors the safety performance of our worldwide electronics plants and distribution infrastructure to maintain the highest safety and compliance standards. We have established programs which range from executive compensation linked to safety performance, to audit and shared learning procedures to ensure that all incidents are communicated, analyzed, and precluded from reoccurring.

Quality System

Quality in the products and services supplied by Praxair is uncompromising. Praxair is committed to providing its customers with the highest quality products, technology, and services available. Proven quality assurance and leadership programs have helped Praxair meet its customers' needs. Praxair's Quality Program is used to direct each employee toward meeting customer expectations all the time.

The Quality Assurance Program includes the application of Statistical Quality Control (SQC) which guides Praxair's chemists and technicians through strict procedures for monitoring and controlling product variation and purity and helps ensure consistent, in-spec product.

Serving the Electronics Sector

With advanced production on three continents including Asia, Europe and North America, Praxair's full line of Semiconductor Process Gases provide the consistent purity that is essential to microelectronics and related high technology manufacturing. Praxair supplies Semiconductor Process Gases that are used throughout all sectors of the industry:

- IC
- LED
- LCD
- Photovoltaics
- Photonics
- Nanotechnology
- Printed circuit board and assembly;

and related technologies.

Praxair is dedicated to helping semiconductor manufacturers lower costs, improve productivity, enhance technology and reduce environmental impact by serving as a single, integrated source for a variety of process gases, materials, and related equipment and services.

Praxair Kingman, AZ

Praxair manufactures, purifies and blends gases for the electronics industry at its production center in Kingman, Arizona. This highly advanced facility has enhanced Praxair's reputation as a leading producer of consistently dependable, ultra-high purity (UHP) gases for all categories of electronic device fabrication. The Kingman facility enables Praxair reliably delivered of quality and consistency for all our electronics gases.

Kingman is uniquely designed to meet the critical quality requirements of the semiconductor industry. These requirements demand not only consistently producing UHP gases but also maintaining purity throughout the cylinder filling operation.

Praxair Technology Center

Praxair's Technology Center located at Tonawanda, New York is dedicated to research on applications, analytical specifications, and systems' design. Satellite Technology Centers are located in major countries around the world.

The Praxair Technology Center personnel in Tonawanda, New York, endeavor to continually enhance equipment performance, analytical methods, contamination reduction programs and new procedures to increase our gas purity and consistency. These dedicated scientists offer cutting edge insights adding to Praxair's commitment to meet the ever-tightening demands of the semiconductor industry.

Gas Handling Systems

Praxair manufactures a complete line of gas handling equipment featuring advanced technologies, including gas cabinets, panels and controllers.

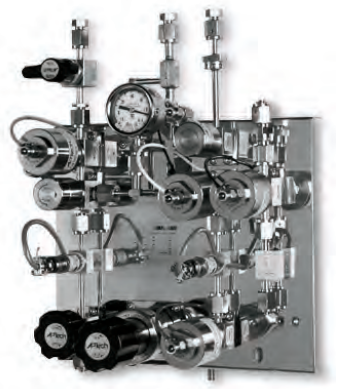
Praxair's *UltraPurge*™ and *SurePurge*™ cabinets and gas handling systems combine time-tested, proven components designed to provide reliable gas delivery, automatic purging, continuous monitoring and emergency shutdown for semiconductor process gases.

In addition, Praxair offers:

- Fast lead times – on systems and parts
- Flexibility – standard panel designs can be customized cost-effectively to meet your individual needs
- Field service – professionals experienced in system installation, predictive maintenance and repair
- Safety – combines the latest safety features with high quality components

Complete systems include:

- One, two, or three-cylinder gas cabinets
- Valve manifold boxes that efficiently distribute gas from a single source point to multiple use points
- Gas isolation boxes that safely isolate gases from process equipment
- Bubbler and liquid delivery systems
- Bulk Specialty Gas Systems (BSGS) for high volume applications

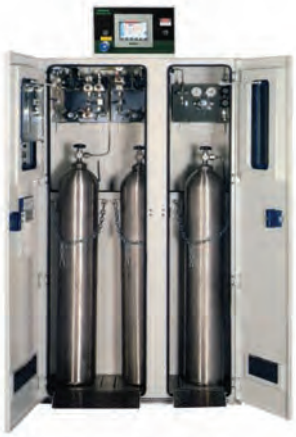


UP6 Process Panel

Fully automatic switchover capability for uninterrupted gas flow. See page E•307 for details.

SurePurge™ 8100

System controller for gas cabinets and panels. See page E•307 for details.



UltraPurge™ 400 Gas Cabinet Series

Praxair's one-, two- and three-cylinder gas cabinets are reliable, easy to use, and are designed to operate safely.
See page E•306 for details.

Types of Semiconductor Process Gases

This table lists the primary process gases used for electronic device fabrication. Other gases are also available.

Atmospheric/Purge Gases
Argon (Ar)
Helium (He)
Hydrogen (H_2)
Krypton (Kr)
Neon (Ne)
Nitrogen (N_2)
Oxygen (O_2)
Xenon (Xe)

Reactant Gases
Carbon Dioxide (CO_2)
Ammonia (NH_3)
Nitrous Oxide (N_2O)
Sulfur Dioxide (SO_2)

Silicon-Precursor Gases
Dichlorosilane (SiH_2Cl_2)
Disilane (Si_2H_6)
Silane (SiH_4)
Silicon Tetrachloride ($SiCl_4$)
Silicon Tetrafluoride (SiF_4)
Trichlorosilane ($SiHCl_3$)
Trimethylsilane ($(CH_3)_3SiH$)

Dopant Gases
Arsine (AsH_3)
Boron Trifluoride (BF_3 and $B^{11}F_3$)
Diborane (B_2H_6)
Germane (GeH_4)
Phosphine (PH_3)

Etchant Gases
Boron Trichloride (BCl_3)
Chlorine (Cl_2)
Halocarbon-14 (CF_4)
Halocarbon-23 (CHF_3)
Halocarbon-41 (CH_3F)
Halocarbon-116 (C_2F_6)
Halocarbon-218 (C_3F_8)
Halocarbon-C318 (C_4F_8)
Hydrogen Chloride (HCl)
Nitrogen Trifluoride (NF_3)
Sulfur Hexafluoride (SF_6)

Electronics

UpTime Sub-Atmospheric Gas Delivery System

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A safe, cost-effective dopant gas delivery system for ion implanters

The *UpTime*® sub-atmospheric dopant gas delivery system is designed as an alternative to existing adsorbent-based technology used in ion implanters. Compared to the existing technology, the *UpTime* system offers industry leading product capacity, higher product purity and a lower cost of ownership.

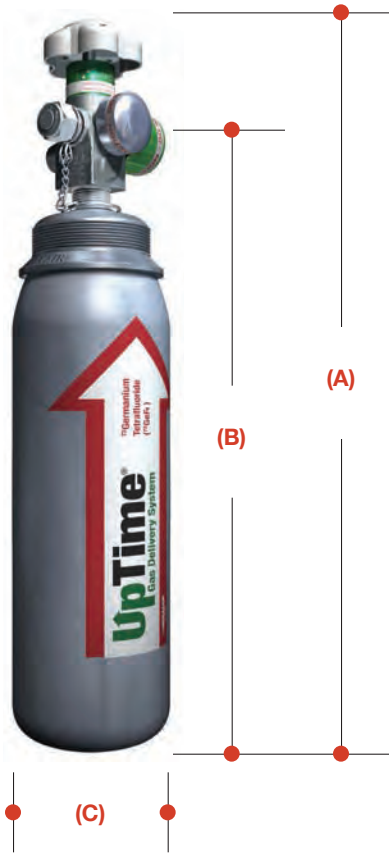
The *UpTime* system is comprised of an internal vacuum actuated valve in series with a specially designed internal flow restrictor. The *UpTime* device is designed to operate safely, with two different types of safeguards: a mechanical actuator and a flow restrictor.

UpTime Product Family

- Enriched Germanium 72 Tetrafluoride
- Germanium Tetrafluoride
- Silicon Tetrafluoride
- Arsine
- Phosphine
- Isotopically Enriched Boron 11 Trifluoride
- Additional *UpTime* implant gases and mixtures are available upon request

Features

- Sub-atmospheric delivery
- Internal flow restrictor limits flow
- SEMI® S2 and S8 compliant
- Highest cylinder product capacity
- High product utilization
- Robust safety features
- Ultra-high purity gas



UpTime Product Family Specifications (ppm)

Gases	Ar/O_2	N_2	H_2O	CO	CO_2	CH_4	C_2 - C_5 Hydrocarbons	PH_3	AsH_3	HF	SO_2	Isotope enrichment
AsH_3	0.5	1	1	0.05	0.05	0.05	0.05	1	–	–	–	–
PH_3	0.5	1	1	0.1	0.1	0.1	0.1	–	0.1	–	–	–
$B^{11}F_3$	50	25	–	–	25	–	–	–	–	25	25	> 99.7%
$Ge^{72}F_4$	50	25	–	25	25	–	–	–	–	–	25	> 50% to < 52%
GeF_4	50	25	–	25	25	–	–	–	–	–	25	–
SiF4	50	25	–	–	25	–	–	–	–	–	–	–

Cylinder Style	Overall Height (inches) (A)	Height to Connection (inches) (B)	Diameter (inches) (C)	Content (grams)					
				AsH_3	PH_3	$B^{11}F_3$	$Ge^{72}F_4$	GeF_4	SiF_4
UT-ELB	16.7	13.9	2	195	100	64	–	–	100
UT-4	18	15.3	4.2	1200	520	–	–	–	–
UT-5	18	15.3	4.4	–	–	–	150	150	–
				–	–	335	400	400	–
				–	–	1100*	700	700	575
UT-6	22.5	19.7	6.25	3600	1600	3300*	–	–	1200

* $B^{11}F_3$ High Capacity fill

Laser Gas Mixtures for DUV Lithography

KrF and ArF

Praxair now offers active, fluorine containing laser gas mixes for KrF (248 nm) and ArF (193 nm) DUV lithography applications. Made in factories dedicated to the electronics industry, Praxair products meet the exacting specifications of the world's leading laser OEMs. Combined with Praxair's unique rare gas production capabilities, our customers are assured of a secure and cost competitive source of these mixes.

Key Benefits:

- Compliant with all laser OEM specifications
- Secure raw material supply
- Produced in plants designed for and dedicated to the electronics markets
- Made with tight tolerance mixing technology and high precision analytical testing

Fluorine/Krypton/Neon (248nm)

Major Components	
F_2	0.9 - 1.0%
Kr	1.2 - 1.3%
Ar	NA
Ne	Balance
Impurities (ppm/v)	
N_2	50
O_2	25
HF/H_2O	25
CH_4	1
CO_2	5
CO	1
CF_4	2
SF_6	1
SiF_4	2
COF_2	2
NF_3	1
He	8
Xe	10

Fluorine/Argon/Neon (193nm)

Major Components	
F_2	0.9 - 1.0%
Kr	NA
Ar	3.4 - 3.6%
Ne	Balance
Impurities (ppm/v)	
N_2	50
O_2	25
HF/H_2O	25
CH_4	1
CO_2	5
CO	1
CF_4	2
SF_6	1
SiF_4	2
COF_2	2
NF_3	1
He	8
Xe	10

KrF/ArF mix

Cylinder	Valve	Contents
44 liter – K	CGA 679/DISS 728	6000 liters
49 liter – T	CGA 679/DISS 728	7500 liters

KrNe and ArXeNe

Praxair Electronics has combined its leading-edge precision mixture manufacturing technology with its captive rare gas production to offer a secure supply of excimer laser inert gas in cost-effective, high volume production.

Praxair's excimer laser products have passed OEM certification, and are available to support advanced photolithography applications.

Key Benefits:

- OEM qualified
- Secure raw material supply
- Regional mixture production
- High precision analytical

Krypton/Neon (248 nm)

Major Components	
Kr (%)	1.25 ± 0.05
Ne	Balance
Impurities (ppm)	
H_2O	< 0.5
O_2	< 0.5
N_2	< 1.0
CH_4	< 0.5
CO	< 0.5
CO_2	< 0.5
CF_4	< 0.5
He	< 8.0
Xe	< 1.0

Argon/Xenon/Neon (193 nm)

Major Components	
Ar (%)	3.5 ± 0.1
Xe (ppm)	10 ± 2
Ne	Balance
Impurities (ppm)	
H_2O	< 0.5
O_2	< 0.5
N_2	< 1.0
CH_4	< 0.5
CO	< 0.5
CO_2	< 0.5
CF_4	< 0.5
He	< 8.0

KrNe/ArXeNe

Cylinder	Valve	Contents
44 liter – K	CGA 580/DISS 718	6000 liters
49 liter – T	CGA 580/DISS 718	7500 liters

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Gas Mixtures for Integrated Circuit Laser Annealing

HCl, Hydrogen, Neon, and Xenon

Praxair has combined its leading edge precision mixture manufacturing technology with its captive rare gas production to offer a secure and cost competitive supply of excimer laser gas mixtures.

Praxair's excimer laser products are available to support annealing for integrated circuit processing at the 308 nm wavelength. These gas mixtures have been OEM and customer tested in high volume manufacturing operations.

Key Benefits

- OEM and customer tested
- Secure raw material supply
- Local production and warehousing
- High precision analytical and production control

HCl/Neon (308)

Major Components	
HCl	0.50%
Ne	Balance
Impurities (ppm)	
CO	< 1
Fe	< 1
H_2O	< 2
N_2	< 15
O_2	< 2

0.5% Hydrogen in Neon

Major Components	
H_2	0.50%
Ne	Balance
Impurities (ppm)	
$CO + CO_2$	< 0.15
H_2O	< 5
N_2	< 5
O_2	< 1
THC	< 0.1

Neon 99.999%

Impurities (ppm)	
CH_4	< 0.5
CO	< 0.5
CO_2	< 0.5
H_2O	< 0.5
He	< 8
N_2	< 1
O_2	< 0.5

10% Xenon in Neon

Major Components	
Xe	10%
Ne	Balance
Impurities (ppm)	
Ar	< 5
CF_4	< 0.1
H_2O	< 1
Kr	< 8
N_2	< 5
O_2	< 0.5
THC	< 0.1

Cylinder	Valve	Contents	Pressure
Per customer specifications	CGA or DISS	Per customer specifications	Per customer specifications

Contact your local Praxair representative or call 1.877.PRAXAIR to learn more about other Excimer Laser Gas applications.

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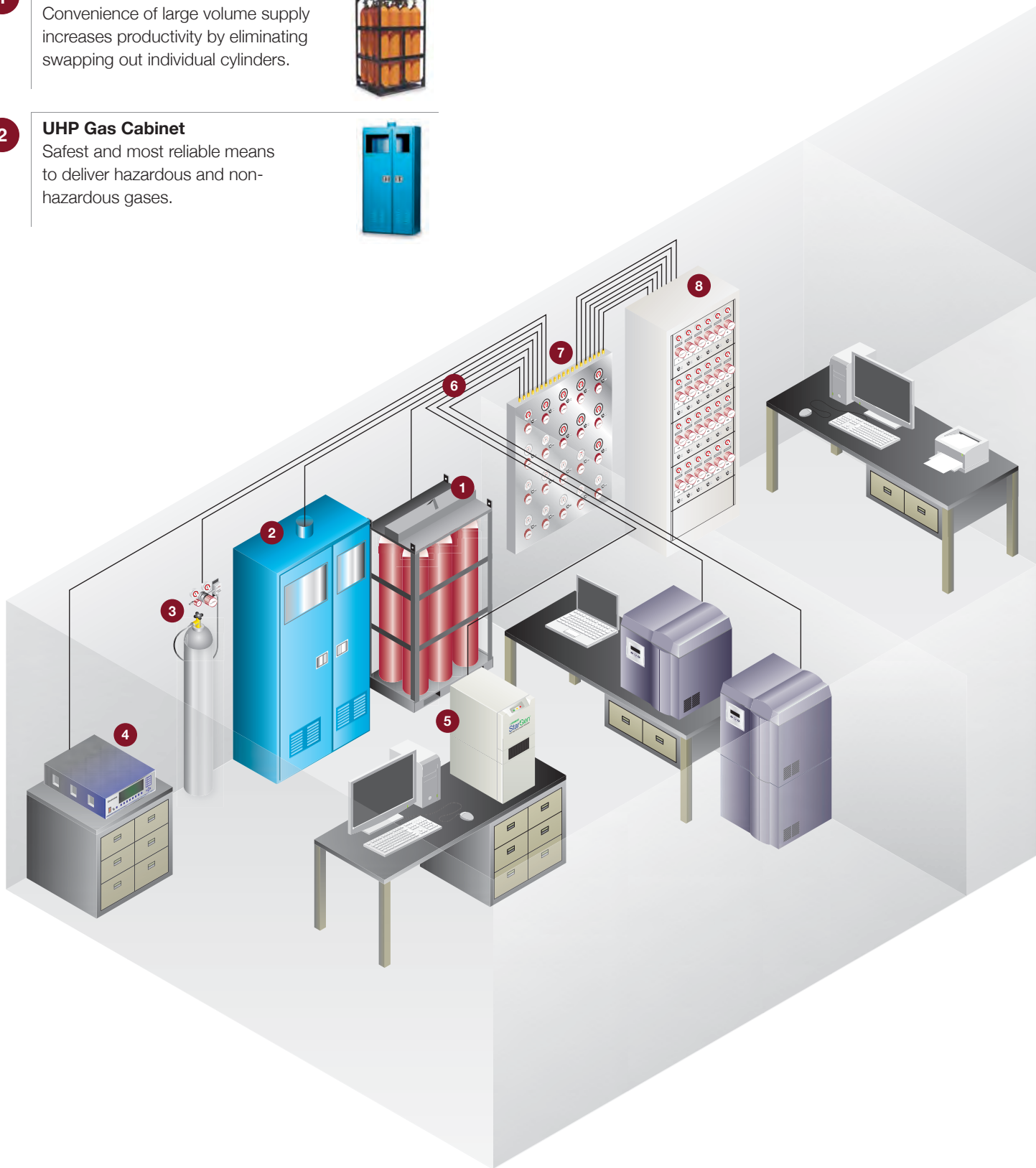
1 **6, 12 or 18 Cylinder Gas Packs**
Convenience of large volume supply increases productivity by eliminating swapping out individual cylinders.

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.

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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.

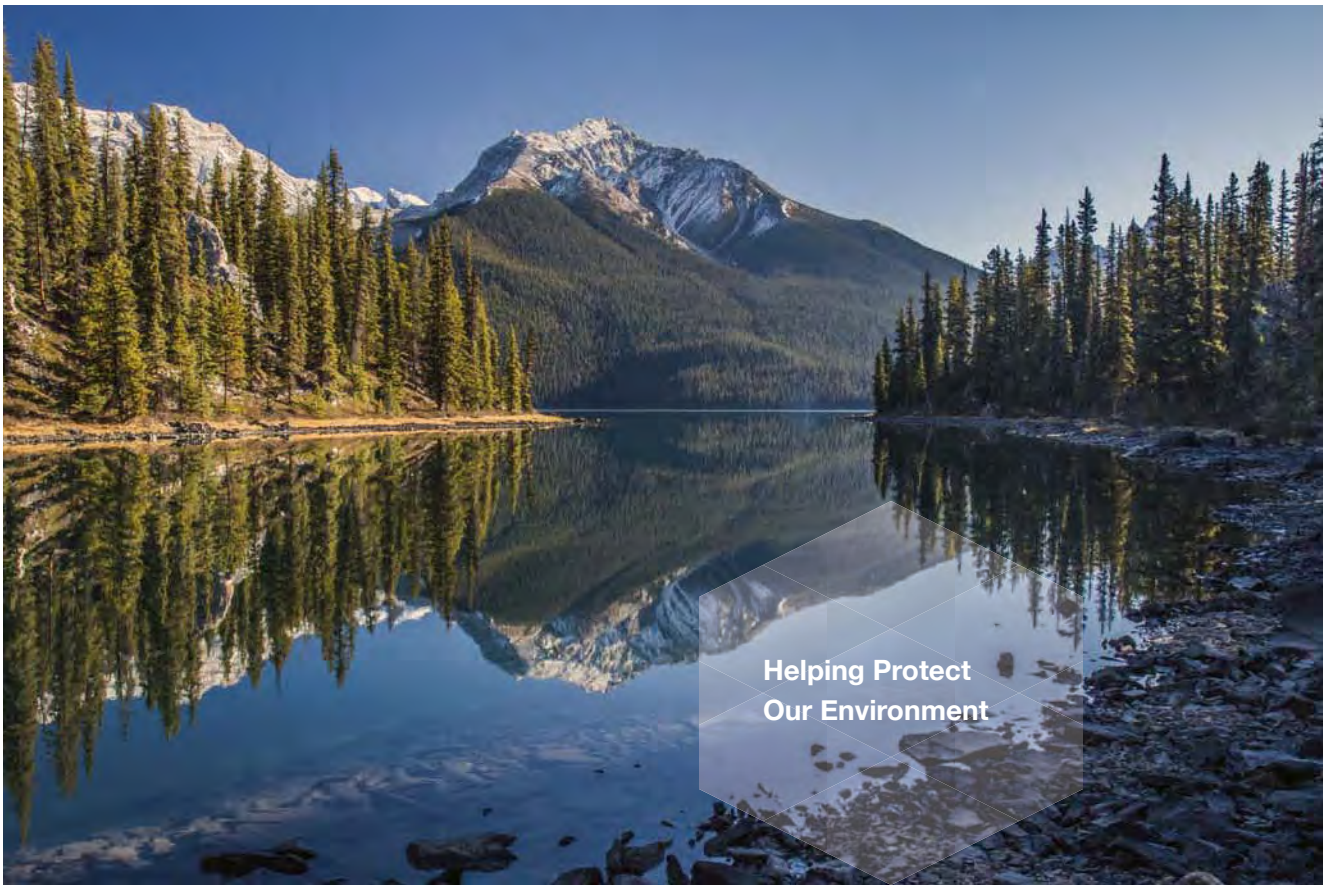
Certificates of Analysis are available upon request.
Mixtures subject to availability.
Other cylinder styles are available upon request.

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

Environmental

Overview



The Praxair Difference

The changing pace of environmental regulations worldwide, coupled with the dynamics of a highly competitive marketplace, produce an array of complex challenges for industries utilizing emissions-monitoring gases. Praxair's environmental monitoring products are designed to provide accurate, cost-effective, and safe solutions while meeting regulatory, service and delivery requirements. As a leading worldwide manufacturer of specialty mixtures, Praxair can meet all your environmental monitoring needs, including:

- Stationary Source Emissions
- Mobile Source Emissions
- Safety and Industrial Hygiene
- Ambient Monitoring

Implicit in these solutions is Praxair's strength as the largest industrial gases company in North and South America and one of the largest worldwide.

- **Comprehensive, High Quality Product Line**
  Certified pure gases and mixtures, an extensive range of gas handling equipment and systems, and a broad range of services provide you with complete environmental monitoring solutions.
- **Application-Based Solutions**
  Sales, production, and research capabilities, and the ability to supply end-use customers with safe, accurate, precise and legally compliant products worldwide.
- **Reliable Production And Distribution Network**
  Maximum reliability throughout North America with 27 specialty gases laboratories/production centers and over 400 distribution locations.
- **Outstanding Technical Support**
  A highly trained team of field sales representatives, technical service personnel and production chemists that provide guidance and support.
- **Global Supplier**
  Application-based research and development at five international technical centers combined with specialty gases production and distribution in over 40 countries around the world.

Praxair's worldwide **ISO 9001: 2000** and **ISO 17025** certified facilities and Declaration of Equivalence agreements between NIST, VSL and others, help ensure that Praxair's mixtures are internationally traceable and consistent.

Environmental

Full Spectrum of Solutions

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Today, industry must carefully monitor its environmental emissions and use precise reference standards to obtain accurate measurements. Praxair is a pioneer in producing highly accurate calibration gas standards and ultra pure zero gases for a wide variety of emissions applications.

Praxair environmental solutions help ensure regulatory compliance, reduce emissions, increase capacity, improve economics and achieve a broad range of environmental benefits.

Key Environmental Segments We Serve

Stationary Source Emissions Monitoring (40 CFR Part 60, 64, 75, 264, 266, and 503)

- CEM Manufacturers
- Utilities
- Co-generation
- Pulp and Paper Plants
- Petrochemical
- Incinerators, including Waste to Energy Plants
- Sewage Plants
- Boilers and Industrial Furnaces
- Cement Kilns
- Steel Mills
- Environmental Testers
- Independent Stack Testing

State-Of-The-Art Production Facilities

Praxair's North American Specialty Gases laboratories are staffed with highly trained and knowledgeable personnel. At each specialty gases facility, they work with the latest cylinder production technology.

- **Cylinder Preparation –** Consistency and stability through pre-treatment, heating, purging and vapor deposition inerting.
- **Blending Systems –** Help ensure your product mixture is produced promptly and accurately to your exact specifications.
- **Analytical Instrumentation –** A full range of the most sensitive instrumentation available.
- **Quality Assurance –** Production technology combines procedures such as EPA methods, ISO certification and interlab audit programs with worldwide standards from NIST, USA; the Netherlands Van Swinden Laboratory (VSL); and the Central Nacional de Metrologia (CENAM), Mexico.

  An internal quality assurance audit program to help ensure your emissions monitoring or measurement systems are performing accurately and according to your specifications. The right procedures and the right standards help ensure the highest quality gases.

Gas Handling Equipment

Further enhancing our pure gases and calibration mixtures offering is our complete line of gas handling, distribution and safety equipment. See Section E for details.

Services

Praxair customers can rely on support services such as:

- **Inventory Management & Cylinder Tracking –** Customer specific gas stocking levels, localized sourcing and delivery schedules reduce inventory carrying costs and improve product lead times.
- **Environmental Gas Management –** Praxair's electronic certificates of analysis and expiration tracking system help to meet your record retention requirements.
- **Technical Consulting and Customer Care –** Technical support, emergency order capability and account management for consistent operation.
- **E-commerce Capabilities –** Online ordering via the Praxair Express™ website provides easy, 24-hour access to product orders, cylinder inventories and safety information.
- **Custom Equipment & Gas Delivery Systems –** Gas delivery systems designed for the critical gas purity and system integrity needed to ensure maximum compliance with process or regulatory purity requirements.
- **EPA Protocol Rush Program –** The maintenance of a continuous inventory of unique environmental mixtures that can be shipped virtually anywhere in the U.S. and Canada at a moments notice.

Declaration of Equivalence agreements between NIST, VSL and other national metrology laboratories help ensure many Praxair mixtures are traceable internationally and all are consistent, regardless of where they are produced.

Environmental

Product Summary

Environmental Grades

Praxair's North American Specialty Gases sales, technical support and production teams will provide you with the right information and products for all your environmental applications.

Our extensive product offering includes:

- **NIST Traceable Reference Materials (NTRM) –** Certified by the National Institute of Standards and Technology (NIST) and accepted by the Environmental Protection Agency (EPA), as the highest accuracy standards commercially available. These standards are the regulatory equivalent to NIST's Standard Reference Materials (SRMs). NTRMS are made using the same components and are within the analytical range of NIST SRMs.
- **EPA Protocols –** These gas mixtures are used for the calibration and audit of Continuous Emission Monitors (CEMs). Praxair EPA Protocols are NIST traceable with a ±1% accuracy and produced in accordance with the latest EPA specifications found in document – EPA 600/R-12/531 Rev. 5/2012.
- **Primary Master –** High accuracy mixtures prepared gravimetrically on electronic high precision scales. These standards are analyzed and named against NIST traceable reference materials.
- **Certified Master –** These routine calibration mixtures are prepared by either gravimetric, volumetric or partial pressure methods and analyzed against NIST traceable reference materials.
- **Dynamic-Blend Master –** These zero blend tolerance mixtures are prepared on an instrument based dynamic blending system. All master gases are analyzed and named against NIST, SRM or NTRMs. Replication for any number of cylinders can be produced with identical concentrations.
- **Dynamic-Blend Standard –** These mixtures are prepared similarly to the Dynamic Blend Master. Certification of the mixtures is based on process accuracy and Praxair Primary Laboratory Standards (PPLS).

Standard Grades

When NIST traceability is not required, Praxair's standard grades are available to meet your working gas requirements.

In addition to Primary, Certified and Non-Certified Standards, Praxair's unique Custom Standard allows you to specify the exact blend tolerance and analytical uncertainty for the mixture.

- **Primary Standard –** Highly accurate mixtures prepared gravimetrically on high-precision electronic balances. These standards are analyzed against Praxair Primary Laboratory Standards (PPLS) and named to a gravimetrically generated concentration.
- **Certified Standard –** These routine calibration mixtures are prepared by either gravimetric, volumetric or partial pressure methods. These standards are analyzed against Praxair Primary Laboratory Standards (PPLS).
- **Non-Certified –** Mixtures are prepared by the same methods and the same care used for Certified Standard Grades. Analyses are not reported.
- **Custom –** Mixtures prepared to the exact blend tolerance and analytical uncertainty requested.

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Mixture Grade	Order Reference	Mixture Component Concentration Range	Blend Pre-Tolerance	Analytical Uncertainty
EV – Environmental Grades[1]				
NTRM	T	N/A	N/A	± 1%
EPA Protocol	E	2 - 25 ppm	± 10%	± 1%
		25.1 - 49.9%	± 5%	± 1%
Primary Master	PM	1 - 9.9 ppm	± 10%	± 0.1 ppm
		10 - 25 ppm	± 10%	± 1%
		25.1 - 9999 ppm	± 5%	± 1%
		1.0 - 49.9%	± 2%	± 1%
Certified Master	CM	1 - 9.9 ppm	± 20%	± 0.2 ppm
		10 - 25 ppm	± 20%	± 2%
		25.1 - 9999 ppm	± 10%	± 2%
		1.0 - 49.9%	± 5%	± 2%
Dynamic Blend Master	DM	1 - 99.9 ppm	Zero	± 2%
		100 ppm - 49.9%	Zero	± 1%
Dynamic Blend Standard	D	1 - 99.9 ppm	Zero	± 5%
		100 ppm - 49.9%	Zero	± 2%
ST – Standard Grades				
Primary Standard	P	1 - 9.9 ppm	± 10%	± 0.1 ppm
		10 - 25 ppm	± 10%	± 1%
		25.1 - 9999 ppm	± 5%	± 1%
		0.1% - 49.9%	± 2%	± 1% or 0.02% abs*
Certified Standard	C	1 - 99.9 ppm	± 20%	± 5%
		100 - 999 ppm	± 10%	± 2%
		0.1 - 49.9%	± 5%	± 2%
Non-Certified Standard	U	1 - 999 ppm	± 20%	N/A
		0.1 - 49.9%	± 10%	
Custom Standard	Z	1 ppm - 49.9%	TBD	TBD

* Whichever is smaller.

[1] All Environmental Grades are NIST traceable. Actual ranges, blend tolerance, and analytical uncertainty are based on available National Institute of Standards and Technology (NIST) SRM concentrations. Please see individual components for specific information.

Note: For all mixtures, blend tolerance and analytical uncertainty specification may vary depending on the chemical characteristics of the component and the cylinder size. For mixtures outside of these ranges, please contact your local Praxair representative.

Environmental Products Cylinder Table

	Pressure		Volume	
Cylinder Style	**psig**	**Bar**	**ft^3**	**m^3**
AS	2000	138	145	4.11
AQ	2200	152	78	2.21
A3	2200	152	29	0.82
T	2640	182	314	8.89
K	2200	152	236	6.68
D7	260	18	8.5	0.24

Note: Nominal contents. Actual volume may vary due to component and/or concentration. Please inquire about other cylinder sizes.

NIST Traceable Reference Materials (NTRMs)

NIST Traceable Reference Materials (NTRM) – Certified by the National Institute of Standards and Technology (NIST) and accepted by the Environmental Protection Agency (EPA), as the highest accuracy standards commercially produced. These standards are the regulatory equivalent to NIST's Standard Reference Materials (SRMs) and are made up of the same components and are within the same analytical range.

The NIST Traceable Reference Materials (NTRM) program, was developed in a consortium with NIST, EPA, and industry participation. The program was intended to increase the availability of NIST traceable primary gas standards to industry. NTRMs supplement the supply of existing gaseous Standard Reference Materials (SRMs) and can be used wherever SRMs have been used in the past. These mixtures are similar in composition to NIST primary and SRM standards. However, because the concentration of the certified component can be bracketed by existing primary NIST standards, NTRM component concentrations can fall above, below or between existing SRM concentrations. This offers end users additional calibration reference points for greater accuracy and lower uncertainty measurements.

NTRMs are manufactured in a batch by Praxair, with NIST assigning the component concentration. The NTRM program was designed to replace the EPA's Certified Reference Material (CRM) program. EPA has stated that it accepts NTRMs in place of CRMs and allows their use as equivalent to SRMs for certification of emissions and production of mixture standards, such as EPA Protocols.

Available mixture components include:

- Carbon Dioxide
- Carbon Monoxide
- Hydrogen Sulfide
- Methane
- Nitric Oxide
- Nitrogen Dioxide
- Oxygen
- Propane
- Sulfur Dioxide

Concentration ranges fall closely above, below or between existing NIST SRM concentrations.

To address any application questions you have, technical support is available from your Praxair Sales Representative or North America Technical Support Center:
1-877-PRAXAIR

EPA Protocols

EPA Protocol gas mixtures are required for the monitoring of emissions from stationary sources and are used for the calibration and Relative Accuracy Test Audit (RATA) of Continuous Emission Monitors (CEMs) as specified under EPA 600/R-12/531.

Praxair EPA Protocols are NIST traceable with a ± 1% accuracy, produced in accordance with the latest EPA specifications. The benefits to you include:

- Certified analytical uncertainty of ±1% is possible for reliable analyzer certification, calibration and audit.
- Multiple production facilities and stocking locations to help ensure an uninterrupted supply of Protocol standards.
- Standards that are labeled and supplied with complete documentation required to help ensure compliance.
- Praxair's cylinder treatment process is designed to provide maximum allowed shelf life within the stated analytical uncertainty. (Please see page D•162 for certification periods).
- Praxair maintains a complete range of NIST Standard Reference Materials (SRMs) and NIST Traceable Reference Materials (NTRMs).

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Component	Balance	Concentration	Certification Period (Years)	CGA	4000 Series Regulator (See Page E•241)
Ammonia	Nitrogen	5 - 50 ppm	1	705	Corrosive
Carbon Dioxide	Air	360 - 420 ppm	8	590	Non-corrosive
Carbon Dioxide	Nitrogen	5 ppm - 20%	8	580	Non-corrosive
Carbon Monoxide	Air	2.5 ppm - 10%	8	590/350	Non-corrosive
Carbon Monoxide	Nitrogen	2.5 ppm - 15%	8	590/350	Non-corrosive
Formaldehyde	Nitrogen	0.5 - 10 ppm	1	330	Corrosive
Hydrogen Chloride	Nitrogen	10 - 5000 ppm	2	330	Corrosive
Hydrogen Sulfide	Nitrogen	1 - 1000 ppm	3	330	Corrosive
Methane	Air	1 - 1000 ppm	8	590/350	Non-corrosive
Methane	Nitrogen	1 ppm - 10%	8	590/350	Non-corrosive
Methanol or Ethanol	Air/Nitrogen	75 - 500 pmm	4	350	Non-corrosive
Natural Gas	Natural Gas	Varies	4	350	Non-corrosive
Nitric Oxide	Nitrogen	0.5 - 50 ppm	3	660	Corrosive
Nitric Oxide	Nitrogen	50 ppm - 1 %	8	660	Corrosive
Nitrous Oxide	Air	1 ppm - 5 %	8	590	Non-corrosive
Oxides of Nitrogen	Air	3 ppm - 1 %	3	660	Corrosive
Oxides of Nitrogen	Nitrogen	10 - 1000 ppm	2	660	Non-corrosive
Oxygen	Nitrogen	10 ppm - 25%	8	590	Non-corrosive
Propane	Air	0.1 - 500 ppm	8	590	Non-corrosive
Propane	Nitrogen	1 ppm - 2 %	8	350	Non-corrosive
Sulfur Dioxide	Air	10 - 100 ppm	2	660	Corrosive
Sulfur Dioxide	Air	100 - 1000 ppm	3	660	Corrosive
Sulfur Dioxide	Nitrogen	1 - 50 ppm	4	660	Corrosive
Sulfur Dioxide	Nitrogen	50 ppm - 1 %	8	660	Corrosive

Important Things to Know

- Multi-component Protocols are assigned a certification period based on the minor component or balance gas with the shortest certification period.
- Protocol concentrations lower than those listed will have an initial 6-month certification period. Upon recertification, acceptable cylinders may have extended certifications.
- Some mixtures may not be available due to critical mixture limitations, safety considerations or SRM availability.
- Analytical uncertainty for certain mixture components and concentrations may vary. The actual analytical uncertainty will be specified on the Certificate of Analysis.
- Trace concentrations of other pollutants in the mixture can be certified on request.
- For CEM zero grade gas products for Air (see pages B•24 and D•163) and Nitrogen (see pages B•65 and D•163).
- Other mixture components or concentrations may be available, please inquire.
- Certification periods apply only to mixtures in aluminum containers.
- EPA Protocol mixtures should not be used below 100 psig.
- Manage your environmental gas and equipment needs online via Praxair Express™.

Environmental

Zero Gases and Customer Service

Zero Gases for Environmental Applications

Setting New Standards of Purity

The U.S. Environmental Protection Agency (EPA) regulations 40 CFR Parts 50, 58, 60, 75 and 266, state that the zero grade air or zero grade nitrogen used for Continuous Emission Monitoring (CEM) must contain no detectable concentration of the pollutant of interest. Furthermore, the zero gas should contain no contaminants that cause a detectable response to the analyzer or that suppress or enhance the analyzer's response. If the zero gas is not certified to be free of critical contaminants, it could be out of compliance.

The Purity and Reliability You Need

Praxair's CEM Zero Air and CEM Zero Nitrogen are developed to meet the stringent requirements of the U.S. EPA 40 CFR Parts 50, 58, 60, 75 and 266. Our manufacturing and certification specifications meet industry standards as well as federal, provincial, state and local regulations.

Clean, Convenient Packaging

Praxair's CEM Zero Air and CEM Zero Nitrogen are packaged in aluminum cylinders. This standard size cylinder (AS) holds 145 ft^3 of air and 143 ft^3 of nitrogen. Larger and smaller containers are also available.

Features

- Meets all U.S. EPA zero and calibration gas standards.
- Stocking programs available.
- Immediate delivery via Praxair truck to most locations
- Over 400 distribution locations nationwide to serve you.
- Available in light-weight aluminum cylinders.

Complete specifications for additional grades of air and nitrogen can be found on page B•24 (Air) and page B•66 (Nitrogen).

Product Specifications

	CEM Zero Air	CEM Zero Nitrogen
Part Number	AI 0.0CE	NI 5.5CE
H_2O	< 2 ppm	< 2 ppm
CO_2	< 1 ppm	< 1 ppm
CO	< 0.5 ppm	< 0.5 ppm
O_2	19.9 - 21.9%	< 0.5 ppm
THC	< 0.1 ppm	< 0.1 ppm
NOx	< 0.1 ppm	< 0.1 ppm
SO_2	< 0.1 ppm	< 0.1 ppm

Industry Leading Customer Support

North America Technical Support Center

Praxair takes your productivity to the next level by giving you easy access to industry-leading technical support. By making a simple call to 1-877-PRAXAIR (1-877-772-9247), you can quickly discuss technical questions or needs with one of our trained experts.

Offers detailed support across Praxair's full line of specialty gases and equipment Praxair experts are ready to help with all of your technical needs, including:

- Application support
- Valve selection guidelines
- Custom safety data sheets
- Mixture feasibility review
- Regulatory compliance inquiries
- Safety guidance
- Up-to-date catalog information

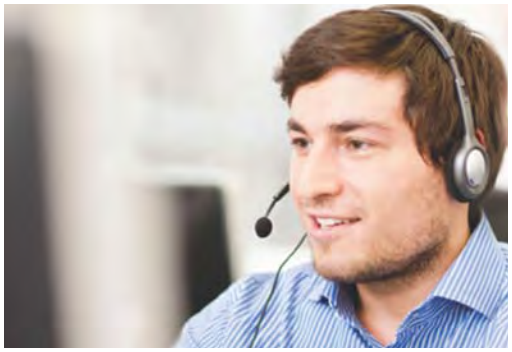
Customer Care Center

Provides a single point of contact for all the information you need about your account. Your dedicated account manager is available to answer any questions you may have, including:

- Account set-up
- Product pricing and quotations
- Order tracking
- Custom specifications
- Delivery inquiries

Our commitment to helping you build your productivity goes beyond just high-quality products and knowledgeable staff – Praxair offers technical service and support, designed to connect you to the breadth and depth of Praxair's expertise acquired over the century we have been in the specialty gas business. The bottom line? No matter what you're looking for, 1-877-PRAXAIR is your right call, first time, every time.

1-877-PRAXAIR is available Monday through Friday, 7:30 a.m. to 6:30 p.m. Eastern time. Prefer email, drop us a line at specialtygases@praxair.com



PRAXAIR
Making our planet more productive

Gas Handling Equipment

Further enhancing our Environmental Monitoring Products offering is our complete line of gas handling, distribution and safety equipment. Praxair's gas handling solutions are designed to help you preserve the purity of your mixture and help you ensure the correct gas flow and delivery pressure.

See Section E for our complete line of high quality gas handling solutions.

Critical Purity Regulator for Non-Corrosive Service

Praxair's 4012 Series regulators are intended for primary pressure control of non-corrosive, high purity gases. See page E•244 for complete specifications.

Part Numbers

Zero Air	PRS40122301-590
Zero Nitrogen	PRS40122301-580

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

Protocol Alarm Station

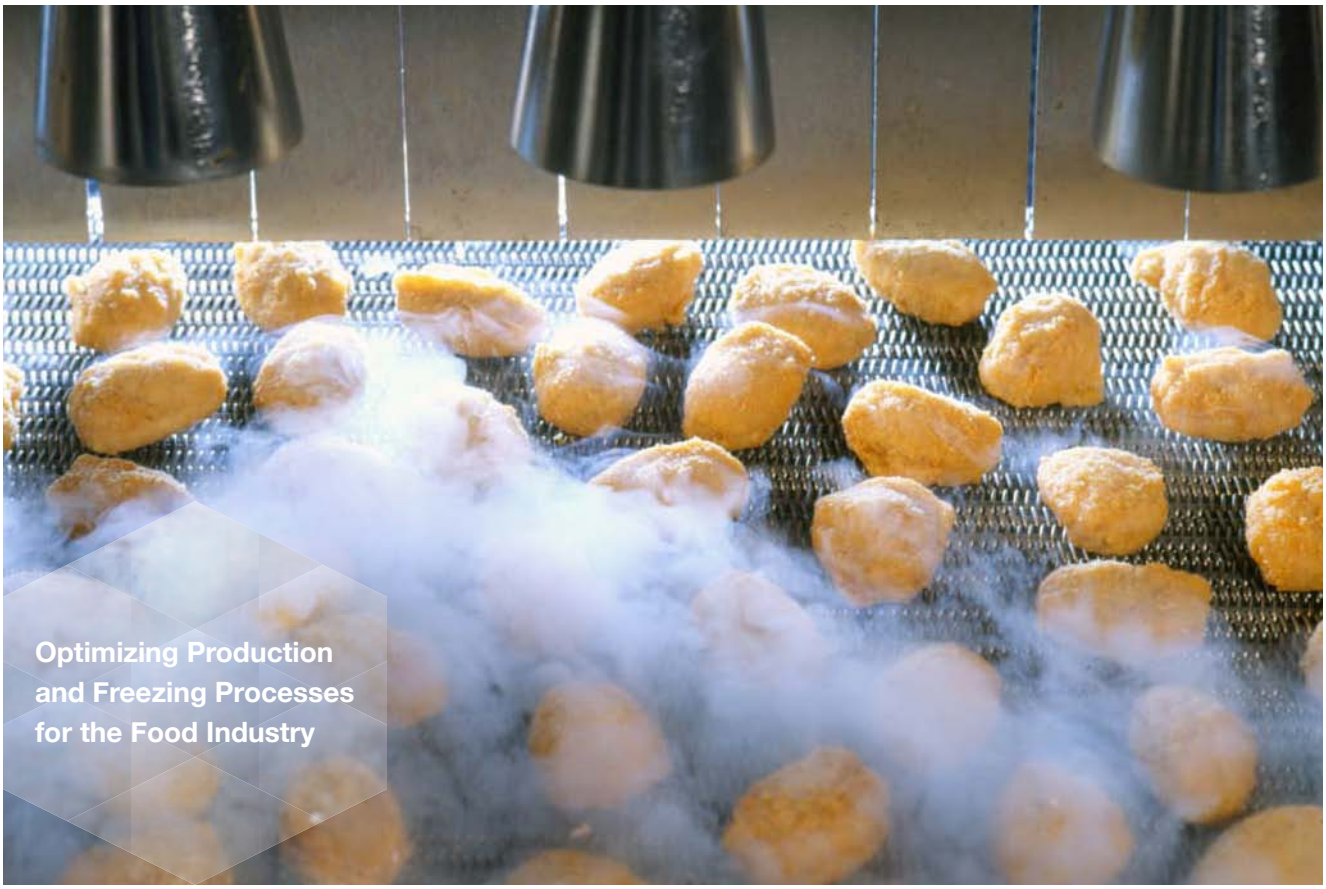
The 5029 Series Protocl Alarm Station combines all of the safety and features of a standard Protocol Station with the added security of a remote alarm system. See page E•283 for complete details.

Part Numbers

Zero Air	PRS50291101-590
Zero Nitrogen	PRS50291101-580

Food

Overview



With over 100 years experience in the food and beverage industry, we have the know-how to help you optimize your production and freezing processes, lower your costs and improve your:

- Yield
- Production throughput
- Efficiency
- Quality

We do this through:

- Expert food analysis at our Food Technology Lab
- Optimal equipment engineering and design
- Expert set-up and start-up from our experienced field support.

First our dedicated team of food scientists can analyze your specific food product to develop your optimal custom processes. Then our world-class engineers will recommend and provide the optimal equipment for your needs. Finally our experienced field team can install, start-up and service your equipment to keep your equipment at top performance.

In short you'll get the temperature control and atmosphere applications you need, backed by the services and systems support you can expect from Praxair.

Comprehensive Product Range
Supplying each application with the proper gas (grade, compliance, certification, scale).

Superior Reliability
Extensive production facilities network to help ensure high quality products are there when they are needed.

Equipment and Systems Excellence
Connecting customers with everything needed to handle and store gases efficiently and safely.

Productivity and Innovation Partner
Working with food industry to identify and implement productivity and cost improvements.

Ease of Doing Business
Providing convenient e-commerce options and strong customer support.

Safety Focus
Making safety the top priority for every activity.

PRAXAIR
Making our planet more productive

The Praxair Food Technology Lab

At Praxair, our Food Technologies Lab provides our customers with the best-fit technology tailored to meet specific food freezing and processing needs. And while our methods are advanced, our goal is very simple: to help you deliver high quality food and beverage products to your customers.

In our Food Technologies Lab, we can analyze your process and provide you with recommendations on how to improve the quality and consistency of your product. Our lab is a full-time facility that has been in operation for over 30 years. Our experienced and dedicated technicians make their recommendations based on their expertise and the evaluation of data collected from thousands of tests on actual food products, in-lab thermal analyses and product testing on production-scale equipment. We will collect data on the thermal characteristics of your product, determine parameters for your freezing and chilling equipment, show what your product looks and tastes like after freezing, and recommend ways to better meet your goals. We are equipped to answer your most difficult product and processing questions so that you can optimize your system. So whether it's maximizing yield, boosting production or perfecting your finished product, our experts are ready to help with a customized assessment of your operation.

Food Freezing and Chilling

Food freezing/cooling/chilling is the process of using direct contact of a cryogen to control or adjust temperature to a frozen or chilled state. Both inline and batch type freezing equipment can be designed to use carbon dioxide or nitrogen to freeze, cool or chill the food. The speed of cryogenic refrigeration helps prevent product degradation, the product retains natural juices and color, and dehydration is drastically reduced.

Almost any food product, (e.g., meat, chicken, fish, dairy, bakery, prepared foods, fruit, vegetables, etc.) can benefit from cooling or freezing, depending on the customer's needs.

Freezing is generally regarded as a food preservation technique. A customer considers freezing or chilling a food product to obtain higher quality products, extend shelf life, expand the distribution area, and make product handling easier.

The consequences of not achieving the desired final temperature include:

- Product handling problems
- Non-compliance with quality assurance (QA) specifications or government regulations
- Shorter shelf life or reduced product quality
- Supplemental freezing

Proper temperature control (cryogenic freezing or chilling) can greatly reduce (or slow) the loss of food product quality caused by bacteria growth, staling, oxidation and mold growth. This application also can overcome mechanical handling problems encountered in processes like packaging, slicing, dicing and other processing.

What is cryogenic freezing?
Freezing is a change in the physical state of a food product when energy, in the form of heat, is removed, changing the water in the food from the liquid state to a solid state.

Praxair specializes in cryogenic freezing using nitrogen or carbon dioxide at low temperatures to quickly freeze food products locking in moisture and product quality.

What is cryogenic chilling?
Cryogenic chilling is the removal of heat from raw and fresh processed foods, cooked or baked foods, and produce at ambient temperatures. Quickly cooling food products is an important step to ensure food safety and improve overall yield.

Praxair specializes in rapid chilling using liquid carbon dioxide and employ's innovative new applications using liquid nitrogen.

Modified Atmosphere Packaging (MAP)

The use of modified atmospheres to replace air in food packages is applicable to many types of food. Controlling food spoilage is complex and more than one gas may be appropriate for the same application. However, specific packaging conditions and shelf life extension requirements play a role in determining which one is most suitable for a given application.

Praxair's *Extendapak*® gases are used by food processors and packagers to extend the shelf life of their products. These gases include pure nitrogen, carbon dioxide and oxygen or a mixture of these products and function to displace unwanted atmospheric gases when used in a Modified Atmosphere Packaging (MAP) process.

MAP represents only one aspect of what a food processor can use to ensure that high quality and safe food reaches the marketplace and, ultimately, the consumer.

Most importantly, MAP does not eliminate or reduce the processor's responsibility for good manufacturing practices. In fact, the opposite is true. MAP is only appropriate for plants producing the cleanest of products. No gas combination in the package will ever reverse a food's poor microbial condition. At its best, MAP will only extend the keeping quality of a food.

Praxair's *Extendapak*® Gases

Product	Praxair	Storage Temperature Food Gases
Red Meats*	14, 15, 16, 30, 32, 38	32-41 °F (0-5 °C)
Processed Meats	2, 12, 14, 15, 16, 23, 24, 26, 28, 30, 31, 32, 33, 34	32-41 °F (0-5 °C)
Poultry	2, 12, 13, 14, 15, 16	32-36 °F (0-2 °C)
Seafood	14, 15, 16, 45	32-36 °F (0-2 °C)
Fresh Fruits	1, 44, 47, 49, 50, 51, 57, 70	41-50 °F (5-10 °C)
Dairy Products	2, 12, 14, 15, 16, 23, 24, 26, 28	34-37 °F (1-3 °C)
Dry and Dehydrated Foods	1, 12, 16, 28	Ambient
Prepared Foods	12, 14, 15, 16, 24, 26, 28	32-41 °F (0-5 °C)
Bakery Products	1, 10, 12, 13, 14, 15, 16, 24, 25, 26, 27, 28	Ambient
Fresh Vegetables	1, 41, 42, 47, 48, 49, 50, 51, 70	32-41°F (0-5°C)

Red Meats

Type	Part Number	Cylinder Style	Content ft³/m³	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Beef (Retail*)	EX 30	T	374/10.36	2640/182	296	P-6303	2000 Series (see pages E•256 - E•258)
		K	275/ 7.62	2200/152	296		
	EX 32	T	290/8.03	1956/135	296		
		K	258/7.15	1956/135	296		
	EX 38	T	220/6.10	1464/101	296		
		K	196/5.43	1464/101	296		
Beef, Lamb, Pork, Veal	EX 16	T	208/5.76	1464/101	580	P-6231	2000 Series (see pages E•256 - E•258)
		K	185/5.13	1464/101	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		
	EX 14	T	338/9.36	2640/182	580		
		K	253/7.01	2200/152	580		

* Cuts that are targeted for immediate retail display are best in EX 30, 32, or 38.
When "bloom" is not necessary, mixtures 16, 15 and 14 are recommended.

When more than one Extendapak number is referenced, mixtures should be evaluated in the same sequence as listed.
Mixtures are prepared with the same care as Certified Standard grade (see page C•92), however analyses are not reported.

Processed Meats

Type	Part Number	Cylinder Style	Content ft³/m³	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Sliced Meats (Bologna, Corned Beef, Ham, Pastrami, Roast Beef, Roast Pork)	EX 14	T	338/9.36	2640/182	580	P-6231	2000 Series (see page E•256)
		K	253/7.01	2200/152	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		
	EX 16	T	208/5.76	1464/101	580		
		K	185/5.13	1464/101	580		
Whole Meats (Corned Beef, Ham, Roast Beef, Roast Pork, Salami, Smoked Meat)	EX 16	T	208/5.76	1464/101	580	P-6231	2000 Series (see page E•256)
		K	185/5.13	1464/101	580		
	EX 12	T	170/4.72	1168/80	580		
		K	152/4.21	1168/80	580		
	EX 28	T	145/4.01	971/67	580		
		K	129/3.57	971/67	580		
	EX 26	T	126/3.50	830/57	580		
		K	112/3.11	830/57	580		
	EX 24	T	112/3.11	724/50	580		
		K	100/2.77	724/50	580		
	EX 23	T	101/2.81	642/44	580		
		K	90/2.50	642/44	580		
	EX 2	K	50/22.7	830/57	320	P-4574	2000 Series (see page E•256)
		Q	20/9.1	830/57	320		
		LC 180	400/182	350/24	622	P-4573	2006 Series (see page E•261)

Poultry – Chicken, Cornish Hens, Duck, Turkey

Type	Part Number	Cylinder Style	Content ft^3/m^3	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Chicken, Cornish Hens, Duck, Turkey (master pack)	EX 2	K	50/22.7	830/57	320	P-4574	2000 Series (see page E•256)
		Q	20/9.1	830/57	320		
		LC180	400/182	350/24	622	P-4573	2006 Series (see page E•261)
(retail)	EX 12	T	170/4.72	1168/80	580	P-6231	2000 Series (see page E•256)
		K	152/4.21	1168/80	580		
	EX 13	T	312/8.64	2350/162	580		
		K	260/7.21	2200/152	580		
	EX 14	T	338/9.36	2640/182	580		
		K	253/7.01	2200/152	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		
	EX 16	T	208/5.76	1464/101	580		
		K	185/5.13	1464/101	580		
Breaded Chicken (cooked)	EX 14	T	338/9.36	2640/182	580	P-6231	2000 Series (see page E•256)
		K	253/7.01	2200/152	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		
	EX 16	T	208/5.76	1464/101	580		
		K	185/5.13	1464/101	580		

Seafood

Type	Part Number	Cylinder Style	Content ft^3/m^3	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Raw White Fish* **Catfish, Cod, Dover, Flounder, Grouper, Haddock, Hake, Halibut, Monfish, Pike, Red Snapper, Shark, Skate**	EX 45	T	214/5.93	1464/101	296	P-6232	2000 Series (see page E•256)
		K	190/5.27	1464/101	296		
Raw, High Fat and Oily Fish* **Carp, Eel, Herring, Mackerel, Salmon, Sardines, Swordfish, Trout, Tuna**	EX 16	T	208/5.76	1464/101	580	P-6231	2000 Series (see page E•256)
		K	185/5.13	1464/101	580		
Crutaceans and Mollusks* **Abalone, Clams, Crab, Conch, Crayfish, Lobster, Mussels, Octopus, Oysters, Prawns, Scallops, Shrimp, Squid**	EX 45	T	214/5.93	1464/101	296	P-6232	2000 Series (see page E•256)
		K	190/5.27	1464/101	296		
Dried Fish*	EX 14	T	338/9.36	2640/182	580	P-6231	2000 Series (see page E•256)
		K	253/7.01	2200/152	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		

*Retail Pak

Dairy Products

Type	Part Number	Cylinder Style	Content ft³/m³	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Milk, Powdered Milk	EX 1	T	304/8.43	2640/182	580	P-4631	2000 Series (see page E•256)
		K	228/6.32	2200/152	580		
		LC 180	4110/114	230/16	295	P-4630	2006 Series (see page E•261)
Cream Cheese, Processed Cheese, Soft Cheese	EX 14	T	338/9.36	2640/182	580	P-6231	2000 Series (see page E•256)
		K	253/7.01	2200/152	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		
	EX 16	T	208/5.76	1464/101	580		
		K	185/5.13	1464/101	580		
Cottage Cheese, Hard Cheese	EX 16	T	208/5.76	1464/101	580	P-6231	2000 Series (see page E•256)
		K	185/5.13	1464/101	580		
	EX 12	T	170/4.72	1168/80	580		
		K	152/4.21	1168/80	580		
	EX 28	T	145/4.01	971/667	580		
		K	129/3.57	971/667	580		
Shredded Cheese	EX 15	T	267/7.41	1956/135	580	P-6231	2000 Series (see page E•256)
		K	238/6.60	1956/135	580		
Ricotta, Sour Cream, Yogurt	EX 28	T	145/4.01	971/67	580	P-6231	2000 Series (see page E•256)
		K	129/3.57	971/67	580		
	EX 12	T	170/4.72	1168/80	580		
		K	152/4.21	1168/80	580		
	EX 16	T	208/5.76	1464/101	580		
		K	185/5.13	1464/101	580		

When more than one Extendapak number is referenced, mixtures should be evaluated in the same sequence as listed.
Mixtures are prepared with the same care as Certified Standard Grade (see page C•92). Analyses are not reported.

Bakery Products

Type	Part Number	Cylinder Style	Content ft³/m³	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Bread, Crumpets, Doughnuts, English Muffins, Muffins, Pastry, Pizza Crusts, Rolls	EX 12	T	170/4.72	1168/80	580	P-6231	2000 Series (see page E•256)
		K	152/4.21	1168/80	580		
	EX 16	T	208/5.76	1464/101	580		
		K	185/5.13	1464/101	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		
Bread Crumbs, Cookies	EX 1	T	304/8.43	2640/182	580	P-4631	2000 Series (see page E•256)
		K	228/6.32	2200/152	580		
		LC 180	4110/114	230/16	295	P-4630	2006 Series (see page E•261)
Cakes	EX 10	T	321/8.90	2640/182	580	P-6231	2000 Series (see page E•256)
		K	241/6.68	2200/152	580		
	EX 12	T	170/4.72	1168/80	580		
		K	152/4.21	1168/80	580		
	EX 13	T	312/8.64	2350/162	580		
		K	260/7.21	2200/152	580		
	EX 14	T	338/9.36	2640/182	580		
		K	253/7.01	2200/152	580		
	EX 15	T	267/7.41	1956/135	580		
		K	238/6.60	1956/135	580		
	EX 16	T	208/5.76	1464/101	580		
		K	185/5.13	1464/101	580		
	EX 1	T	304/8.43	2640/182	580	P-4631	2000 Series (see page E•256)
		K	228/6.32	2200/152	580		
		LC 180	4110/114	230/16	295	P-4630	2006 Series (see page E•261)

Fruits

Type	Part Number	Cylinder Style	Content ft³/m³	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Apples, Apricots, Honeydew, Orange Sections, Pears	EX 70	T	312/8.83	2640/182	580	P-6231	2000 Series (see page E•256)
		K	235/6.65	2200/152	580		
Blueberries, Cherries	EX 47	T	321/8.91	2640/182	580	P-6231	2000 Series (see page E•256)
		K	241/6.69	2200/152	580		
	EX 51	T	315/8.73	2640/182	580		
		K	237/6.57	2200/152	580		
Grapes	EX 1	T	304/8.43	2640/182	580	P-4631	2000 Series (see page E•256)
		K	228/6.32	2200/152	580		
		LC180	4110/114	230/16	295	P-4630	2006 Series (see page E•261)
Kiwi, Nectarines, Plums Peaches	EX 51	T	315/8.73	2640/182	580	P-4631	2000 Series (see page E•256)
		K	237/6.57	2200/152	580		
	EX 51	T	315/8.73	2640/182	580	P-4631	2000 Series (see page E•256)
		K	237/6.57	2200/152	580		
	EX 49	T	316/8.78	2640/182	590		
		K	238/6.59	2200/152	590		
Raspberries	EX 49	T	316/8.78	2640/182	590	P-4631	2000 Series (see page E•256)
		K	238/6.59	2200/152	590		
	EX 50	T	324/8.97	2640/182	590		
		K	243/6.73	2200/152	590		
	EX 51	T	315/8.73	2640/182	580		
		K	237/6.57	2200/152	580		
Strawberries	EX 57	T	341/9.46	2640/182	590	P-4631	2000 Series (see page E•256)
		K	255/7.07	2200/152	590		
	EX 44	T	340/9.43	2640/182	580		
		K	254/7.04	2200/152	580		

When more than one Extendapak number is referenced, mixtures should be evaluated in the same sequence as listed. Mixtures are prepared with the same care as Certified Standard Grade (see page C•92). Analyses are not reported.

For ordering purposes, please add the desired cylinder style to the end of the designated part number.

Fresh Vegetables

Type	Part Number	Cylinder Style	Content ft³/m³	Pressure psig/bar	CGA	(M)SDS	Regulator Recommendation
Asparagus	EX 49	T	316/8.78	2640/182	590	P-4631	2000 Series (see page E•256)
		K	238/6.59	2200/152	590		
	EX 50	T	324/8.97	2640/182	590		
		K	243/6.73	2200/152	590		
	EX 51	T	315/8.73	2640/182	580		
		K	237/6.57	2200/152	580		
Brussel Sprouts, Cabbage, Carrots, Cauliflower, Radishes	EX 51	T	315/8.73	2640/182	580	P-4631	2000 Series (see page E•256)
		K	237/6.57	2200/152	580		
Corn, Sweet Potatoes	EX 49	T	316/8.78	2640/182	590	P-4631	2000 Series (see page E•256)
		K	238/6.59	2200/152	590		
Lettuce, Peppers, Spinach, Vegetable Salads	EX 70	T	312/8.83	2640/182	580	P-6231	2000 Series (see page E•256)
		K	235/6.65	2200/152	580		
Beans, Brocolli, Onions	EX 47	T	321/8.91	2640/182	580	P-6231	2000 Series (see page E•256)
		K	241/6.69	2200/152	580		
	EX 51	T	315/8.73	2640/182	580		
Potatoes	EX 50	T	324/8.97	2640/182	590	P-4631	2000 Series (see page E•256)
		K	243/6.73	2200/152	590		
	EX 49	T	316/8.78	2640/182	590		
		K	238/6.59	2200/152	590		
Tomatoes	EX 50	T	324/8.97	2640/182	590	P-4631	2000 Series (see page E•256)
		K	243/6.73	2200/152	590		
	EX 42	T	334/9.26	2640/182	590		
		K	250/6.93	2200/152	590		

When more than one Extendapak number is referenced, mixtures should be evaluated in the same sequence as listed.
Mixtures are prepared with the same care as Certified Standard Grade (see page C•92). Analyses are not reported.

PRAXAIR
Making our planet more productive

Hydrocarbon Processing

Overview

Full Spectrum Product Line

Today's hydrocarbon processing industries (HPI) requires high precision measurement, uniform stability, specialty mixes, and reference standards. Praxair's Spectrum products offer a wide range of certified mixes, industry reference standards, and high purity organics. The production of natural gas, liquefied petroleum gas, engine fuels, and ethane are analyzed to meet process feed and salable product specifications. Spectrum gases and liquid mixes are formulated to certifiable references and to meet standards for your low sulfur fuels and natural gases, vapor pressure, LPG standards, and HVOC requirements. Praxair possesses an extensive portfolio of assayed chemicals to customize your requirements.

Centers of Excellence

To effectively service North America, Praxair has three centers of excellence dedicated for hydrocarbons. These centers are located in Geismar, Louisiana; Edmonton, Alberta, Canada, and Mexico City, Mexico. Each of these centers have advanced cylinder treatment capabilities, blending systems, and analytical equipment to effectively service the HPI market. They are supported by specialty gas experts who are actively involved in the HPI market.

Other support comes from Praxair R&D, where teams of scientists are dedicated to the development of specialty gas products and services.

Reliable Production and Distribution

Praxair possesses multiple ISO 9001:2000 certified plants with 5 specialty gas plants and North America's largest gas production facility working to provide the highest quality products, product availability, and meeting on time delivery requirements. With over 600 US locations, our distribution network accompanied by our ability to supply custom delivery solutions for packaged and bulk products allows Praxair to offer packaged and bulk options that may help you increase your productivity.

A Complete Range of Gas Delivery Equipment

Praxair's offers a wide range of essential equipment to meet the demands of today's hydrocarbon processing facility laboratories and process feed monitoring instrumentation gas delivery solutions. From specialty regulators for corrosive service to hydrogen laboratory generators, Praxair's expertise can help you provide process improvement which can result in reduced costs.

Hydrocarbon Processing

Overview

PRAXAIR
Making our planet more productive

Oil and gas exploration...refineries...petrochemical/chemical plants...gas processing units...distribution networks. Perfomance expectations for each of these hydrocarbon processing industry (HPI) operations have never been greater. Key to achieving and maintaining this performance level are the many gases employed in this multipurpose industry. Meeting today's complex hydrocarbon processing challenges requires more than a reliable, single-source supplier of industrial gases. It takes a total solutions company like Praxair.

As a world leader in manufacturing and distributing atmospheric, process and specialty gases, Praxair is uniquely positioned to apply unparalleled systems and resources to create innovative, cost-effective solutions for the hydrocarbon processing industry – now and in the future.

Praxair hydrocarbon processing solutions will help improve productivity, increase capacity, reduce emissions and enable performance monitoring and tracking. From bulk quantities to 17-liter portables, Praxair offers the largest selection of gases, containers, and delivery systems in the industry.

Industry Wide Association Interface

Most customers have individual needs, but in some cases problems are evaluated and resolved under the umbrella of a trade or industry wide association. Praxair works with many of these organizations, including ASTM D-2, D-3, GPA, WSPA and API.

Refining

Refiners worldwide rely on Praxair's extensive product capabilities, high-quality processes, vast distribution network and commitment to customer service and satisfaction. Pipeline and on-site production...bulk, tube trailer and cylinder supply...a complete line of equipment and accessories – Praxair offers a full spectrum of products and services to meet your needs.

Please refer to page D•177 for information on the products that support the refining industry.

Natural Gas

From the well head to the power plant, Praxair delivers products and services needed by the natural gas industry. Supported by the most extensive distribution network in North America, Praxair is dedicated to exploring new and innovative solutions to the nation's energy and natural gas demands.

Please refer to D•182 for information on the products that support the natural gas industry.

Petrochemical

Praxair's specialty gases production facilities provide products for petro-chemical and petroleum related products. Including a wide range of both pure organics and mixtures and the delivery systems to support them. Praxair is the hydrocarbon processing industry's preferred supplier.

Please refer to page D•183 for information on the products that support the petrochemical industry.

Hydrocarbon Processing

Refining

A Complete Product Line

Whether for lab analysis or process control, Praxair offers a wide range of pure organics and mixtures in many container types and sizes. Our ISO 9001:2000 Certified Advanced Application Group in Geismar, Louisiana, for example, specializes in unusual organic matrices and trace impurities.

Praxair's high-quality manufacturing process features:

- Computerized phase behavior evaluation
- High-purity assayed raw materials
- Proprietary cylinder preparation
- Precise gravimetric blending systems
- Certification and/or confirmation analysis

Typical Liquid Mixtures

ASTM D-3710 Compounds	Conc. (LV%)
Propane	1.0
Isobutane	3.0
n-Butane	10.0
Isopentane	9.0
n-Pentane	7.0
2-Methylpentane	5.0
n-Hexane	5.0
2,4-Dimethylpentane	5.0
n-Heptane	9.0
Toluene	10.0
n-Octane	5.0
p-Xylene	12.0
n-Propylbenzene	3.0
n-Decane	3.0
n-Butylbenzene	3.0
n-Dodecane	3.0
n-Tridecane	2.0
n-Tetradecane	2.0
n-Pentadecane	2.0

Typical Refinery Gas Standard

Compounds	Conc.
Hydrogen	38.5%
Methane	15.0%
Propane	8.0%
Ethylene	7.5%
Ethane	7.0%
Nitrogen	4.0%
Carbon Dioxide	3.0%
Propylene	3.0%
n-Butane	2.5%
Isobutane	2.0%
Carbon Monoxide	2.0%
1-Butene	1.0%
Isobutylene	1.0%
trans-2-Butene	1.0%
cis-2-Butene	1.0%
Acetylene	1.0%
n-Pentane	0.5%
Isopentane	0.5%
Argon	1.0%
1-Pentene	0.1%
trans-2-Pentene	0.1%
cis-2-Pentene	0.1%
2-methyl 2-Pentene	0.1%
n-Hexane	0.1%

Trace Impurity Mixtures

Fuel Standards	
MTBE	100 ppm
Isooctane	Balance
Dibutyl Disulfide	1 ppm
Isooctane	Balance
Industrial Hygiene	
Hydrogen Sulfide	Up to 300 ppm
Carbon Monoxide	Up to 300 ppm
Methane	2.5%
Oxygen	19%
Nitrogen	Balance

See pages D•185-202 for more information.

Environmental	
Carbon Dioxide	10%
Carbon Monoxide	50 ppm
Nitric Oxide	100 ppm
Sulfir Dioxide	250 ppm
Nitrogen	Balance

See pages D•157-164 for more information.

Total Sulfur Standards

Reduced sulfur blends in inert matrix.
NIST traceable to H_2S SRM.

Compounds	Minimum Conc.
Carbon Disulfide	1.0 ppm
Carbonyl Sulfide	95 ppb
Dimethyl Disulfide*	0.5 ppm
Dimethyl Sulfide	0.5 ppm
Ethyl Mercaptan	1.0 ppm
Methyl Mercaptan	1.0 ppm
Propyl Mercaptan	2.0 ppm

* Dimethyl Disulfide must be blended separately due to instability and reactivity with other components.

Hydrocarbon Processing

Multicomponent Mixes

PRAXAIR
Making our planet more productive

Praxair can supply gas blends containing over 100 individual components. Our Mix-Cal software program evaluates your specific product mix needs verifying component compatibility and calculates the mixture requirements ensuring safe multicomponent high quality gas blends.

- (1S)-(-)-B-Pinene
- (R)-3,7-Dimethyl-1,6-octadiene
- (S)-3,7-Dimethyl-1,6-octadiene
- 1,1,1,2,2,3,3,4,4-Nonafluoro-4-methoxybutane
- 1,1,2-Trimethylcyclopentane
- 1,1,3-Trimethylcyclopentane
- 1,1-Dichloro-1,2,2,2-tetrafluoroethane
- 1,1-Diethylcyclopentane
- 1,1-Dimethyl-2-ethylcyclopentane
- 1,1-Dimethylcyclohexane
- 1,1-Dimethylcyclopentane
- 1,2,3,4-Tetrahydronaphthalene
- 1,2,3,5-Tetramethylbenzene
- 1,2,3-Trimethylbenzene
- 1,2,4,5-Tetramethylbenzene
- 1,2,4-Triethylbenzene
- 1,2,4-Trimethylbenzene
- 1,2-Dichlorobenzene
- 1,2-Dichloroethane-d4
- 1,2-Diphenylethane
- 1,2-Ethanedithiol
- 1,2-Hexadiene
- 1,2-Pentadiene
- 1,3,5-Triethylbenzene
- 1,3-Butadiene
- 1,3-Cyclopentadiene
- 1,3-Dichloro-1,1,2,2,3-pentafluoropropane
- 1,3-Dichlorobenzene
- 1,3-Dichloropropenes (Mixed Isomers)
- 1,3-Dioxane
- 1,3-Hexachlorobutadiene
- 1,3-Propanediol
- 1,4-Dichlorobenzene
- 1,4-Dioxane
- 1,4-Pentadiene
- 1,5-Hexadiene
- 1,6-Hexanedithiol
- 1,cis-2,cis-3-Trimethylcyclopentane
- 1,cis-2,cis-4-Trimethylcyclopentane
- 1,cis-2,trans-3-Trimethylcyclopentane
- 1,cis-2,trans-4-Trimethylcyclopentane
- 1,trans-2,cis-3-Trimethylcyclopentane
- 1,trans-2,cis-4-Trimethylcyclopentane
- 1-Bromo-4-fluorobenzene
- 1-Bromobutane
- 1-Bromopropane
- 1-Butene
- 1-Chloro-1,1,2,2-tetrafluoroethane
- 1-Chloro-1,1-difluoroethane
- 1-Chloro-1,2,2,2-tetrafluoroethane
- 1-Chloro-1-fluoroethylene
- 1-Chloro-2,2,2-trifluoroethane
- 1-Decanethiol
- 1-Decanol
- 1-Decyne
- 1-Eicosene
- 1-Ethydecahydronaphthalene (Mixed Isomers)
- 1-Ethyl-cis-decahydronaphthalene
- 1-Ethylcyclohexene
- 1-Ethylcyclopentene
- 1-Ethyl-trans-decahydronaphthalene
- 1-Fluorobutane
- 1-Fluoropentane
- 1-Heptadecene
- 1-Heptanethiol
- 1-Heptyne
- 1-Hexanethiol
- 1-Hexyne
- 1-Methoxy-2-methylbutane
- 1-Methyl-1-butyne
- 1-Methyl-1-ethylcyclopentane
- 1-Methyl-1-n-propylcyclopentane
- 1-Methyl-1-propanethiol
- 1-Methyl-2-pyrrolidinone
- 1-Methyl-4-isopropylcyclohexane
- 1-Methyl-cis-decahydronaphthalene
- 1-Methylcyclohexene
- 1-Methylcyclopentene
- 1-Methyldecahydronaphthalene (Mixed Isomers)
- 1-Methylnaphthalene
- 1-Methyl-trans-decahydronaphthalene
- 1-Nitrobutane
- 1-Nitropropane
- 1-Nonadecene
- 1-Nonanethiol
- 1-Nonene
- 1-Nonyne
- 1-Octanethiol
- 1-Octyne
- 1-Pentadecene
- 1-Pentanethiol
- 1-Pentyne
- 1-Propanethiol
- 1-Tridecene
- 1-Undecanol
- 1-Undecene
- 2,2,3,3-Tetramethylbutane
- 2,2,3,3-Tetramethylhexane
- 2,2,3,3-Tetramethylpentane
- 2,2,3,4-Tetramethylpentane
- 2,2,3-Trimethylbutane
- 2,2,3-Trimethylhexane
- 2,2,3-Trimethylpentane
- 2,2,4,4-Tetramethylpentane
- 2,2,4-Trimethylhexane
- 2,2,5,5-Tetramethylhexane
- 2,2,5-Trimethylhexane
- 2,2-Dichloro-1,1,1-trifluoroethane
- 2,2-Difluoropropane
- 2,2-Dimethyl-3-ethylpentane
- 2,2-Dimethylheptane
- 2,2-Dimethylhexane
- 2,2-Dimethylpentane
- 2,2-Dimethylpropane
- 2,3,3,4-Tetramethylpentane
- 2,3,3-Trimethyl-1-butene
- 2,3,3-Trimethyl-1-pentene
- 2,3,3-Trimethylhexane
- 2,3,3-Trimethylpentane
- 2,3,5-Trimethylhexane
- 2,3-Dimethyl-1,3-butadiene
- 2,3-Dimethyl-1-butene
- 2,3-Dimethyl-1-hexene
- 2,3-Dimethyl-1-pentene
- 2,3-Dimethyl-2-butene
- 2,3-Dimethyl-2-hexene
- 2,3-Dimethyl-2-pentene
- 2,3-Dimethylhexane
- 2,3-Dimethylpentane
- 2,3-Hexadiene
- 2,3-Pentadiene
- 2,4,4-Trimethylhexane
- 2,4-Dimethyl-1-pentene
- 2,4-Dimethyl-2-pentene
- 2,4-Dimethyl-3-ethylpentane
- 2,4-Dimethyl-3-isopropylpentane
- 2,4-Dimethylhexane
- 2,5-Dimethylfuran
- 2,5-Dimethylhexane
- 2,6-Dimethyl-1,6-heptadiene
- 2,6-Dimethylheptane
- 2,6-Dimethylnaphthalene
- 2,6-Octadiene
- 2,7-Dimethyloctane
- 2-Bromopropane
- 2-Bromothiophene
- 2-Butanol
- 2-Chloro-1,1-difluoroethylene
- 2-Chloro-2-ethylvinyl ether
- 2-Ethyl-1-hexanol
- 2-Ethyl-1-hexene
- 2-Ethyl-1-pentene

Hydrocarbon Processing

Multicomponent Mixes

Praxair is a full service supplier for all your hydrocarbon processing gas needs. Refer to section E for information on Praxair's complete line of gas delivery equipment. For additional information or technical assistance, contact our North American Technical Support Center at 1-877-PRAXAIR.

- 2-Ethyl-3-methyl-1-butene
- 2-Hexanone
- 2H-Pentafluoropropylene
- 2-Methoxybenzyl alcohol
- 2-Methyl-1,5-hexadiene
- 2-Methyl-1-butanethiol
- 2-Methyl-1-buten-3-yne
- 2-Methyl-1-heptene
- 2-Methyl-1-hexene
- 2-Methyl-1-pentene
- 2-Methyl-1-propanethiol
- 2-Methyl-2,4-hexadiene
- 2-Methyl-2-butanethiol
- 2-Methyl-2-butanol
- 2-Methyl-2-hexene
- 2-Methyl-2-nitropropane
- 2-Methyl-3-ethylpentane
- 2-Methylfuran
- 2-Methylheptane
- 2-Methylhexane
- 2-Methylnaphthalene
- 2-Methylnonane
- 2-Methyloctane
- 2-Methylthiophene
- 2-Nitropropane
- 2-Octene (Mixed Isomers)
- 2-Pentene (Mixed Isomers)
- 2-Pentyne
- 2-Propanethiol
- 3,3,3-Trifluoropropene
- 3,3,4-Trimethylheptane
- 3,3,4-Trimethylhexane
- 3,3,5-Trimethylheptane
- 3,3-Dichloro-1,1,1,2,2-pentafluoropropane
- 3,3-Diethylpentane
- 3,3-Dimethyl-1-butene
- 3,3-Dimethyl-1-pentene
- 3,3-Dimethylhexane
- 3,3-Dimethylpentane
- 3,4-Dimethyl-1-pentene
- 3,4-Dimethylhexane
- 3,7-Dimethyl-1,6-octadiene
- 3-Ethyl-1-hexene
- 3-Ethyl-1-pentene
- 3-Ethyl-2-pentene
- 3-Ethylcyclopentene
- 3-Ethylheptane
- 3-Ethylhexane
- 3-Ethylpentane
- 3-Ethylthiophene
- 3-Methyl-1,2-pentadiene
- 3-Methyl-1-butene
- 3-Methyl-1-heptene
- 3-Methyl-1-hexene
- 3-Methyl-1-pentenes (Mixed Isomers)
- 3-Methyl-2-butanol
- 3-Methyl-2-pentenes (Mixed Isomers)
- 3-Methyl-3-ethylpentane
- 3-Methyl-3-heptene
- 3-Methylcyclopentene
- 3-Methylhexane
- 3-Methylnonane
- 3-Methyloctane
- 3-Methylthiophene
- 4,4-Dimethyl-1-pentene
- 4-Ethyl-1-hexene
- 4-Methyl-1-heptene
- 4-Methyl-1-hexene
- 4-Methyl-1-pentene
- 4-Methyl-2-hexene (Mixed Isomers)
- 4-Methyl-2-pentene (Mixed Isomers)
- 4-Methylcyclopentene
- 4-Methylheptane
- 4-Methylnonane
- 4-Methyloctane
- 4-Methylstyrene
- 4-tert-Butylhydroquinone
- 4-Vinyl-1-cyclohexene
- 5-Ethylidene-2-norbornene
- 5-Methyl-1-hexene
- 5-Methylnonane
- 5-Nonanone
- 5-Vinyl-2-norbornene
- 6-Methyl-2-heptene
- 9-Ethyl-cis-decahydronaphthalene
- 9-Ethyldecahydronaphthalene (Mixed Isomers)
- 9-Ethyl-trans-decahydronaphthalene
- Acetaldehyde
- Acetic acid
- Acetone
- Acrolein
- Acrylic acid
- Acrylonitrile
- Allyl alcohol
- Allyl chloride
- Amyl ethyl ether
- Amyl tert-butyl ether
- Aniline
- Benzaldehyde
- Benzene
- Benzyl alcohol
- Benzyl chloride
- Benzyl sulfide
- Butane
- Butyl acrylate
- Butylcyclohexane
- Butylcyclopentane
- Carbon Disulfide
- Carbon Disulfide
- Carbon tetrachloride
- Carbonyl sulfide
- Chlorobenzene
- Chloroform
- cis-1,2-Dichloroethylene
- cis-1,2-Diethylcyclopentane
- cis-1,2-Dimethylcyclohexane
- cis-1,2-Dimethylcyclopentane
- cis-1,2-Dimethylcyclopropane
- cis-1,3-Dichloro-1-propene
- cis-1,3-Dimethylcyclohexane
- cis-1,3-Dimethylcyclopentane
- cis-1,3-Pentadiene
- cis-1,4-Dimethylcyclohexane
- cis-1-Methyl-2-ethylcyclopentane
- cis-1-Methyl-3-ethylcyclopentane
- cis-2,2-Dimethyl-3-hexene
- cis-2-Butene
- cis-2-Heptene
- cis-2-Hexene
- cis-2-Methyl-3-hexene
- cis-2-Octene
- cis-3,4-Dimethyl-2-pentene
- cis-3-Heptene
- cis-3-Hexene
- cis-3-Methyl-2-hexene
- cis-3-Methyl-2-pentene
- cis-3-Methyl-3-hexene
- cis-3-Octene
- cis-4,4-Dimethyl-2-pentene
- cis-4-Methyl-2-hexene
- cis-4-Methyl-2-pentene
- cis-4-Octene
- cis-5-Methyl-2-hexene
- cis-Decahydronaphthalene
- cis-Penten-3-yne-1
- Cresol (Mixed Isomers)
- Cyanogen
- Cycloheptane
- Cyclohexanol
- Cyclohexanone
- Cyclohexene
- Cyclononane
- Cyclooctane
- Cyclopropane

Hydrocarbon Processing

Multicomponent Mixes

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Making our planet more productive

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- Decahydronaphthalene, (Mixed Isomers)
- Dibenzothiophene
- Dicyclohexane
- Dicyclopentadiene
- Diethanolamine
- Diethyl Disulfide
- Diethyl ether
- Diethyl sulfide
- Diethylamine
- Diethylbenzenes (Mixed Isomers)
- Diethyoxymethane
- Difluoromethane
- Diisobutyl sulfide
- Diisopropyl disulfide
- Diisopropyl sulfide
- Dimethyl ether
- Dimethyl methylphosphonate
- Dimethyl sulfide
- Dimethyl trisulfide
- Dimethylacetamide
- Dimethylamine
- Dimethylethylamine
- Dimethylnaphthalenes (Mixed Isomers)
- Dimethylsulfoxide
- Diphenyl
- Diphenylmethane
- Di-tert-butyl peroxide
- Di-tert-butyl sulfide
- d-Limonene
- Docosane
- Dotriacontane
- Eicosane
- Epichlorohydrin
- Ethane
- Ethanethiol (Ethyl Mercaptan)
- Ethanol
- Ethyl chloride
- Ethyl disulfide
- Ethyl fluoride
- Ethyl iodide
- Ethyl methacrylate
- Ethyl methyl disulfide
- Ethyl methyl ether
- Ethyl propyl ether
- Ethyl tert-amyl ether
- Ethyl tert-butyl ether
- Ethylacetylene
- Ethylamine
- Ethylcyclobutane
- Ethylcycloheptane
- Ethylcyclohexane
- Ethylcyclopentane
- Ethylcyclopropane
- Ethylene
- Ethylene dibromide
- Ethylene glycol
- Ethylene glycol monobutyl ether
- Ethylene oxide
- Ethylenediamine
- Fluorobenzene
- Formaldehyde
- Furfural
- Halocarbon-410a
- Halothane
- Helium-3
- Henicosane
- Heptacosane
- Hexachlorobenzene
- Hexacosane
- Hexafluoro-1,3-butadiene
- Hexamethyldisiloxane
- Hexatriacontane
- Humulene
- Hydrogen
- Hydrogen bromide
- Hydrogen chloride
- Hydrogen fluoride
- Hydrogen iodide
- Hydrogen sulfide
- Indan
- Indene
- Isoamyl acetate
- Isoamyl mercaptan
- Isobutane
- Isobutanol
- Isobutyl acrylate
- Isobutyl Mercaptan
- Isobutyl methacrylate
- Isobutylbenzene
- Isobutylcyclohexane
- Isobutylcyclopentane
- Isobutylene
- Isohexene
- Isopentane
- Isoprene
- Isopropanol
- Isopropyl Disulfide
- Isopropyl ether
- Isopropyl fluoride
- Isopropyl Mercaptan
- Isopropyl nitrate
- Isopropylamine
- Isopropylbenzene
- Isopropylcyclohexane
- Isopropylcyclopentane
- m-Chlorotoluene
- m-Cresol
- m-Diethylbenzene
- Menthol
- Methane
- Methanol
- Methyl acrylate
- Methyl bromide
- Methyl chloride
- Methyl ethyl sulfide
- Methyl fluoride
- Methyl formate
- Methyl isobutyl ketone
- Methyl isopropyl ketone
- Methyl mercaptan
- Methyl perfluoropropyl ether
- Methyl propyl ether
- Methyl tert-butyl ether
- Methylacetylene
- Methylamine
- Methylcyclobutane
- Methylcycloheptane
- Methylcyclohexane
- Methylcyclopentane
- Methyl-d3-benzene-d5
- Methyl-d3-ether
- m-Ethyltoluene
- N,N-Dimethylformamide
- Naphthalene
- Natural gas
- n-Butanol
- n-Butyl Disulfide
- n-Butyl disulfide
- n-Butyl mercaptan
- n-Butyl methacrylate
- n-Butyl sulfide
- n-Butylacetate
- n-Decylcyclohexane
- n-Decylcyclopentane
- n-Dodecyl alcohol
- n-Dodecylcyclohexane
- n-Dodecylcyclopentane
- n-Eicosylcyclohexane
- n-Eicosylcyclopentane
- N-Formylmorpholine
- n-Heptadecane
- n-Heptadecylcyclohexane
- n-Heptadecylcyclopentane

Hydrocarbon Processing

Multicomponent Mixes

Praxair is a full service supplier for all your hydrocarbon processing gas needs. Refer to section E for information on Praxair's complete line of gas delivery equipment. For additional information or technical assistance, contact our North American Technical Support Center at 1-877-PRAXAIR.

- n-Heptane
- n-Heptylcyclohexane
- n-Heptylcyclopentane
- n-Hexadecylcyclohexane
- n-Hexadecylcyclopentane
- n-Hexaldehyde
- n-Hexane
- n-Hexanol
- n-Hexylcyclopentane
- n-Hexylcylcohexane
- Nitroethane
- Nitromethane
- Nitrosyl chloride
- n-Nonadecylcyclohexane
- n-Nonanonic acid
- n-Nonyl alcohol
- n-Nonyl aldehyde
- n-Nonylcyclohexane
- n-Nonylcyclopentane
- n-Nonyldecylcyclopentane
- n-Octadecane
- n-Octadecylcyclohexane
- n-Octadecylcyclopentane
- n-Octanol
- n-Octylcyclohexane
- n-Octylcyclopentane
- Nonacosane
- Nonadecane
- n-Pentadecylcyclohexane
- n-Pentadecylcyclopentane
- n-Pentane
- n-Pentylbenzene
- n-Pentylcyclohexane
- n-Pentylcyclopentane
- n-Propyl benzene
- n-Propyl Disulfide
- n-Propyl Mercaptan
- n-Propyl nitrate
- n-Propyl Sulfide
- n-Tetradecyl alcohol
- n-Tetradecylcyclohexane
- n-Tetradecylcyclopentane
- n-Tridecylcyclohexane
- n-Tridecylcyclopentane
- n-Undecylcyclohexane
- n-Undecylcyclopentane
- o-Cresol
- Octacosane
- o-Dichlorobenzene-d4
- o-Diethylbenzene
- o-Ethyltoluene
- Oxygen
- p-Chlorotoluene
- p-Cresol
- p-Diethylbenzene
- Pentacosane
- Pentafluoroethane
- Perfluoro (methyl vinyl ether)
- Perfluoro-2-butene (Mixed Isomers)
- Perfluorobutane
- Perfluoropropyl vinyl ether
- p-Ethyltoluene
- Phenol
- Phenyl ether
- Phenyl isocyanate
- Phenyl mercaptan
- Phenyl sulfide
- Piperylenes (Mixed Isomers)
- Propadiene
- Propane
- Propionic acid
- Propionitrile
- Propyl disulfide
- Propyl sulfide
- Propylamine
- Propylcyclohexane
- Propylcyclopentane
- Propylene
- Propylene glycol
- Propylene oxide
- sec-Butlycyclohexane
- sec-Butyl ether
- sec-Butyl Mercaptan
- sec-Butyl methyl ether
- sec-Butyl Sulfide
- sec-Butylbenzene
- sec-Phenethyl alcohol
- Squalane
- Sulfur
- Sulfur dioxide
- Sulfur trioxide
- tert-Amyl methyl ether
- tert-Butyl alcohol
- tert-Butyl disulfide
- tert-Butyl mercaptan
- tert-Butyl Sulfide
- tert-Butylbenzene
- tert-Butylcatechol
- tert-Butylcyclohexane
- Tetracontane
- Tetracosane
- Tetrafluoromethane
- Tetrahydrofuran
- Tetrahydrothiophene
- Tetramethylene sulfone
- Tetratetracontane
- Tetratriacontane
- Thianaphthene
- Thiophene (Thiofuran)
- Toluene
- trans-1,2-Dichloroethylene
- trans-1,2-Dimethylcyclohexane
- trans-1,2-Dimethylcyclopentane
- trans-1,2-Dimethylcyclopropane
- trans-1,3-Dichloro-1-propene
- trans-1,3-Dimethylcyclohexane
- trans-1,3-Dimethylcyclopentane
- trans-1,3-Pentadiene
- trans-1,4-Dimethylcyclohexane
- trans-1-Methyl-2-ethylcyclopentane
- trans-1-Methyl-3-ethylcyclopentane
- trans-2-Butene
- trans-2-Heptene
- trans-2-Hexene
- trans-2-Methyl-3-hexene
- trans-2-Octene
- trans-3,4-Dimethyl-2-pentene
- trans-3-Heptene
- trans-3-Methyl-2-hexene
- trans-3-Methyl-2-pentene
- trans-3-Methyl-3-hexene
- trans-3-Octene
- trans-4,4-Dimethyl-2-pentene
- trans-4-Methyl-2-pentene
- trans-4-Octene
- trans-5-Methyl-2-hexene
- trans-Decahydronaphthalene
- trans-Penten-3-yne-1
- Triacontane
- Tricosane
- Tridecyl alcohol
- Triethylamine
- Triisobutylene
- Trimethylamine
- Vinyl acetylene
- Vinyl chloride
- Vinyl fluoride
- Vinyl methyl ether
- Xylenes (Mixed Isomers)

α-Diisobutylene
α-Farnesene
α-Methylstyrene
α-Pinene
β-Diisobutylene

PRAXAIR
Making our planet more productive

Extensive Distribution Network

Through a robust network of hundreds of supply points served by dozens of gas plants, Praxair provides reliable delivery of gases, supply systems, advanced process and applications technologies, and other services that deliver exceptional value to the natural gas industry.

Pure specialty and industrial grade gases are available in high pressure or ultra high pressure cylinders, multi-packs or tube trailers to meet any requirement.

Refer to Section A – Cylinders and Containers for details.

Typical Natural Gas Reference Standards

Component Concentration (Mol %)	GPA** Gas Reference	High Helium Reference	Danalyzer™ Mixture	C7+ Natural Gas Mixture	Sour Natural Gas Mixture	Extended Natural Gas Mixture	Natural Gas Mixture	Pipeline Natural Gas Mixture	High Ethane Gas Mixture
Argon	–	–	–	–	0.4	0.37500	–	–	–
n-Butane	3.0	1.0	0.3	0.3	0.3	0.30000	0-5.0	0.10	3.00
Carbon Dioxide	1.0	0.3	1.0	1.0	1.0	1.00000	0-25.0	0.60	0.50
n-Decane	–	–	–	–	–	0.00018	*	–	–
n-Dodecane	–	–	–	–	–	0.00005	*	–	–
Ethane	9.0	3.0	5.0	4.6	6.0	6.00000	0-10.0	4.0	12.50
Helium	0.5	2.0	–	–	0.5	0.50000	–	–	–
n-Heptane	–	–	–	0.03	0.02	0.00075	*	–	–
n-Hexane	–	–	0.03	0.05	0.05	0.02300	*	–	–
Hydrogen Sulfide	–	–	–	–	1.0	–	0-25.0	–	–
Isobutane	3.0	1.0	0.3	0.3	0.3	0.30000	0-5.0	–	3.00
Isopentane	1.0	0.3	0.1	0.1	0.1	0.10000	0-1.0	0.03	0.50
Methane	70.5 (Balance)	88.7 (Balance)	89.57 (Balance)	90.0 (Balance)	87.12 (Balance)	86.99999 (Balance)	70-90 (Balance)	94 (Balance)	64 (Balance)
Methyl Mercaptan	–	–	–	–	–	–	–	4 ppm	–
Nitrogen	5.0	1.6	2.5	2.5	2.0	3.00000	–	0.60%	9.00
n-Nonane	–	–	–	0.004	–	0.00018	–	–	–
n-Octane	–	–	–	0.016	0.01	0.00075	–	–	–
Propane	6.0	1.8	1.0	1.0	1.0	1.30000	0-6.0	0.40	7.0
n-Pentane	1.0	0.3	0.1	0.1	0.1	0.10000	0-1.0	0.02	0.50
Neopentane	–	–	0.1	–	0.1	–	–	–	–
n-Tridecane	–	–	–	–	–	0.00005	*	–	–
n-Undecane	–	–	–	–	–	0.00005	*	–	–

* C6+: As specified by enduser (Dewpoint restrictions may apply, All concentrations must add up to 100%).
** Gas Processors Association

Praxair provides a wide range of mixtures with either overall mixture accuracy or component uncertainty.

Praxair's full line of environmental products support compliance and regulatory needs of the natural gas industry. See page D•162 for a complete listing of grades and specifications.

The 2002 Series regulators are designed for primary pressure control of non-corrosive, high-purity or liquefied gases. It is useful for applications where minor fluctuations in outlet pressure due to diminishing inlet supply pressure can be tolerated.

Part number PRS20022731-510. See page E•257 for options and detailed specifications.

2002 Series Regulator

Pure Organic Products

The Pure Gases section (see pages B•21 to B•88), includes a wide range of pure organic products. Praxair's extensive supplier network provides access to a wide range of raw materials. These raw materials often have more stringent specifications than other commercially available materials. In-house proprietary purification is also used in cases where higher specifications are required.

High Purity Organics

Chemical	Grade	Quality	Page Number
1, 3 Butadiene	2.5	99.5%	B•30
n-Butane	3.0	99.9%	B•31
Ethylene	5.0	99.999%	B•42
Isobutane	4.0	99.99%	B•58
Isobutylene	3.0	99.9%	B•59
Methane	5.0	99.999%	B•61
Propane	4.0	99.99%	B•72
Propylene	2.8	99.8%	B•73

Petrochemical Mixtures

Praxair provides a wide range of mixtures for both process control and product quality QA/QC. The products meet ASTM 2163 and/or GPA standard 2140.

LPG Reference Standards

Component	Propane	Isopentane	n-Pentane	Propylene	Propane/ Propylene	Butane
1-3, Butadiene	3.0%	–	–	20 ppm	–	–
2,2-Dimethylbutane	–	–	2.0%	–	–	–
2,3-Dimethylbutane	–	–	1.0%	–	–	–
Benzene	–	–	1.0%	–	–	–
n-Butane	3.0%	4.0%	–	40 ppm	0.1-1%	30-64%
cis-2-Butene	3.0%	0.1%	–	50 ppm	–	–
trans-2-Butene	3.0%	0.1%	–	30 ppm	–	–
Carbon Monoxide	–	–	–	–	–	–
Cyclohexane	–	–	2.0%	–	–	–
Cyclopentane	–	–	2.0%	–	–	–
Ethane	3.0%	–	–	–	0.1-4%	0-2%
Ethylene	3.0%	–	–	–	–	–
n-Hexane	–	–	2.0%	–	–	–
Isobutane	5.0%	0.6%	–	60 ppm	1-3%	15-25%
Isobutylene	–	–	–	40 ppm	1-3%	0-6%
Isopentane	–	95.0% (Bal)	5.0%	–	0-1%	0-2%
Isoprene	–	0.2%	–	–	–	–
Methane	1.0%	–	–	–	–	–
Methyl Cyclopentane	–	–	1.0%	–	–	–
2-Methylpentane	–	–	2.0%	–	–	–
3-Methylpentane	1.0%	–	1.0%	–	–	–
n-Pentane	5.0%	–	81.0% (Bal)	–	–	–
Propane	70.0% (Bal)	–	–	–	4-94%	3-45%
Propylene	–	–	–	99.97% (Bal)	4-95%	0-6%

Technical Support

A highly trained team of field sales representatives, technical support personnel and production chemists provides the guidance and support needed to resolve regulatory, technical and safety issues.

For technical support, call the North America Technical Support Center at 1-877-PRAXAIR

Liquid Containers

Praxair offers liquid mixtures in aluminum cylinders (4L, 2L, 1L, 500ml, 250ml). These containers are effective in maintaining the integrity of complex matrices over extended periods. We continually look for new packaging techniques to enhance our hydrocarbon products. Please call us with your special packaging requests.

Welker® Piston Cylinders

Available in 250cc – 1000cc these highly specialized containers which have working pressures of 2000 psi.

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Making our planet more productive

Highly Reactive Volatile Organic Compounds (HRVOC) Standards

Praxair provides a variety of standards used in Highly Reactive Volatile Organic Compounds testing of environmental conditions. The most common products and ranges are listed below. Please inquire if you have special requirements which are not listed.

Highly Reactive Volatile Organic Compound (HROC) testing of vents, flares, cooling towers and fugitive emissions requires calibrations standards used by the equipment which verifies air quality and composition. In addition to the most common analytes of Ethylene, Propylene, 1,3 butadiene and butene, other products and concentration ranges are available and listed. Please inquire if you have special requirements which are not listed.

Typical Components	Concentration Range	Nitrogen Matrix	Methane Matrix	Helium Matrix	Hydrogen Matrix
Methane	3 ppm-Balance Gas	4-60 ppm	Balance	–	–
Ethane	3 ppm-12%	4-60 ppm	–	–	10 ppm-20%
Ethylene	3 ppm-12%	4-60 ppm	4-12%	3-160 ppm	10 ppm-10%
Acetylene	3-8000 ppm	–	–	3-160 ppm	–
Propane	3-8000 ppm	4-60 ppm	–	3-160 ppm	10 ppm-1%
Propylene	3-8000 ppm	–	4-3000 ppm	3-160 ppm	10 ppm-1%
Isobutane	3-8000 ppm	4-60 ppm	–	–	10-1000 ppm
n-Butane	3-8000 ppm	4-60 ppm	–	–	10-1000 ppm
trans-2-Butene	3-8000 ppm	–	4-5500 ppm	3-160 ppm	–
cis-2-Butene	3-8000 ppm	–	4-5500 ppm	3-160 ppm	–
1-Butene	3-8000 ppm	–	–	3-160 ppm	10-1000 ppm
isoButylene	3-8000 ppm	–	4-3000 ppm	3-160 ppm	–
isoPentane	3-8000 ppm	–	–	–	–
n-Pentane	3-8000 ppm	4-400 ppm	–	–	–
1,3 Butadine	3-8000 ppm	–	10-5500 ppm	3-160 ppm	10-1000 ppm
Hydrogen	0-Balance Gas	–	1-10%	–	Balance
Nitrogen	0-Balance Gas	Balance	0.5-12%	–	–
Helium	0-Balance Gas	–	–	Balance	–

Ultra Low Sulfur Diesel Fuel and Gasoline Standards

Recognizing the global trend to reduce sulfur levels in fuels to meet recommended guidelines established by the World Wide Fuel Charter, Praxair can provide sulfur standards customized to meet your requirements. Praxair offers stable high quality standards for your fuel calibration needs. Please inquire if you have special requirements which are not listed.

Total or speciated sulfur and nitrogen available for liquid and gas phase blends.

Total Sulfur in Diesel Fuel could be ordered as Dibenzothiophene, Thiophene, Hydrogen Sulfide or n-Butyl Sulfide. The most common ranges are listed below but other ranges are also available.

All liquid cylinders will contain an inert pressure pad based on the customer's specifications of either Nitrogen or Helium. The pressure and the volume of the pressure pad will vary depending on the cylinder size required for the mixture.

Component	Dibenzothiophene	Thiophene	Hydrogen Sulfide	n-Butyl Sulfide
Total Sulfur as	1-30 ppm	1-25 ppm	1-10 ppm	1-300 ppm
Diesel Fuel	Balance Gas	Balance Gas	Balance Gas	Balance Gas

Total Sulfur in Gasoline may be ordered as Benzothiophene, Dimethyl Sulfide, Hydrogen Sulfide or n-Butyl Sulfide. Sulfur Standards in a gasoline matrix may be ordered as either isoOctane or a blend of Toluene and isoOctane.

The most common ranges are listed below but other ranges are also available. All liquid cylinders will contain an inert pressure pad based on the customer's specifications of either Nitrogen or Helium. The pressure and the volume of the pressure pad will vary depending on the cylinder size required for the mixture.

Component	Benzothiophene	Dimethyl Sulfide	Hydrogen Sulfide	n-Butyl Sulfide
Total Sulfur as	1-30 ppm	1-50 ppm	1-10 ppm	1-150 ppm
Gasoline	Balance Gas	Balance Gas	Balance Gas	Balance Gas

Industrial Hygiene

Overview

The Praxair Nationwide Network

Your industry is just one of many that is protecting its workers by monitoring ambient air for toxic gases. The Praxair solution is to provide a calibration and delivery system which can help you to ensure the reliability of your monitoring processes.

Companies across North America in a wide range of industries know Praxair's nationwide production and distribution network as a dependable source of these gases. Praxair has collaborated with industry, regulatory agencies, and instrument manufacturers to ensure you receive a creative and cost effective system, that provides accurate and reliable calibration products.

Praxair continues to enhance its industrial hygiene offering with the addition of the *PortaGas*™ product line and its *PortaGreen*™ and *Strip & Ship*™ programs. The *Strip & Ship* program reduces the work – and the cost – associated with standard cylinder disposal. To learn more see page D•198.

Comprehensive Product Range
Praxair's nationwide network provides the pure gases, non-reactive and reactive mixtures in a correctly sized transportable cylinder.

Superior Reliability
Praxair's network offers decades of hands-on experience and a support staff of trained, knowledgeable, experienced professionals who provide one-on-one customer service.

Convenience
Smaller-sized, lightweight cylinders require no deposit or monthly rental charge, are easier to handle, less expensive to ship, and they occupy very little space.

Ease of Doing Business
Providing convenient e-commerce options and strong customer support.

Safety Focus
Making safety the top priority for every activity.

Industrial Hygiene

Overview

PRAXAIR
Making our planet more productive

Transportable Cylinders for Pure Gases – Steel

- **Cylinder Style:** D17
- **Gas Contents:** 17 L
- **Pressure:** 240 psig
- **Connection CGA:** 600
- **Material of Construction:** Steel
- **Weight:** 1.1 lb
- **Dimensions:** 3" x 10-3/4"
- **DOT Rating:** DOT 39 NRC
- **Regulator:** 400 Series

- **Cylinder Style:** D34
- **Gas Contents:** 34 L
- **Pressure:** 500 psig
- **Connection CGA:** 600
- **Material of Construction:** Steel
- **Weight:** 1.4 lb
- **Dimensions:** 3" x 10-3/4"
- **DOT Rating:** DOT 39 NRC
- **Regulator:** 400 Series

Transportable Cylinders for Non-Reactive Gas Mixtures – Steel

- **Cylinder Style:** D103
- **Gas Contents:** 103 L
- **Pressure:** 1000 psig
- **Connection:** C-10 5/8" – 18 UNF
- **Material of Construction:** Steel
- **Weight:** 2.3 lb
- **Dimensions:** 3-1/4" x 13-2/3"
- **DOT Rating:** DOT 39 NRC
- **Regulator:** 500, 600 and 8000 Series

- **Cylinder Style:** D221
- **Gas Contents:** 221 L
- **Pressure:** 260 psig
- **Connection CGA:** 165
- **Material of Construction:** Steel
- **Weight:** 6.3 lb
- **Dimensions:** 9" x 16-1/2"
- **DOT Rating:** DOT 39 NRC
- **Regulator:** 300 and 6000 Series

Pure Gases Products

- Air
- Argon
- Carbon Dioxide
- Helium
- Hydrogen
- Nitrogen
- Oxygen
- Propane

Non-Reactive Gas Mixture Products

- Butane
- Carbon Dioxide
- Carbon Monoxide
- Ethane
- Ethylene
- Hexane
- Hydrogen
- Isobutylene
- Iso-Pentane
- Methane
- Propane
- Propylene
- N-Pentane
- Methyl Chloride
- Oxygen
- Toluene

Features and Benefits

- High blend accuracy
- Up to 2% analytical uncertainty
- Certificates of analysis can be provided for mixtures and pure gases in transportable cylinders
- Product traceability
- Customized mixtures available upon request
- Shipped direct to customers

For additional information please refer to Praxair's Transportable Cylinders literature, P-9924.

Products

- Calibration Standards
- Zero Gases
- Emergency Oxygen Kits

Applications

- Workplace air monitoring
- Confined space entry
- Monitoring toxic emissions
- Safety
- Refrigeration
- Wall mounted and personal monitors calibration
- Medical stations
- Emergency response kits
- Laboratory field analysis

Industries Served

- Hydrocarbon Processing Industry
- Chemical Processing Industry
- Grain Processing/Grain Storage
- Automotive
- Aerospace/Aviation
- Marine Terminals
- Furniture Manufacturers
- Utilities/Power Plants
- Fire Departments
- Waste Management

Transportable Cylinders for Reactive Gas Mixtures – Aluminum

- **Cylinder Style:** D550
- **Gas Contents:** 550 L
- **Pressure:** 2000 psig
- **Connection CGA:** According to filled gas
- **Material of Construction:** Steel
- **Weight:** 12.9 lb
- **Dimensions:** 4-1/6" x 20-1/2"
- **DOT Rating:** DOT E8990 NRC
- **Regulator:** 200 or 300 Series

- **Cylinder Style:** D34A
- **Gas Contents:** 34 L
- **Pressure:** 500 psig
- **Connection:** C-10 5/8" – 18 UNF
- **Material of Construction:** Aluminum
- **Weight:** 0.8 lb
- **Dimensions:** 2-7/8" x 11-1/2"
- **DOT Rating:** DOT 39 NRC
- **Regulator:** 500 Series

- **Cylinder Style:** D58
- **Gas Contents:** 58 L
- **Pressure:** 500 psig
- **Connection:** C-10 5/8" – 18 UNF
- **Material of Construction:** Aluminum
- **Weight:** 1.6 lb
- **Dimensions:** 2-7/8" x 11-1/2"
- **DOT Rating:** DOT 39 NRC
- **Regulator:** 500, 6000 or 8000 Series

- **Cylinder Style:** D76
- **Gas Contents:** 76 lts
- **Pressure:** 500 psig
- **Connection:** C-10 5/8" – 18 UNF, also available with CGA 170 upon request
- **Material of Construction:** Aluminum
- **Weight:** 1.75 lbs
- **Dimensions:** 4" x 16-1/4"
- **DOT Rating:** DOT 39 NRC
- **Regulator:** 500 Series

Typical 550 Cylinder Products

- Argon
- Nitrogen
- Carbon Dioxide
- Carbon Monoxide
- Helium
- Non Reactive Mixtures

Reactive Gas Mixture Products

- Ammonia
- Benzene
- BTEX (Benzene, Toluene, Ethyl Benzene, o-Xylene)
- Chlorine
- Ethylene Oxide
- Hydrogen Cyanide
- Hydrogen Sulfide
- Nitric Oxide
- Nitrogen Dioxide
- Sulfur Dioxide

Transportable Cylinder Accessories

Two Cylinder Carrying Case, with a split door that permits convenient access to regulators and valves (fits D103 transportable cylinder), Model PRS-CC2

Single Ring Style Stand, for 3.25" to 4.25" Diameter Bottles, PRS-835

Single Ring Style Stand, for 7" to 8.75" Diameter Bottles, PRS-837

Also available, wall or cart mounted Steel Ring Stand for 3.25" to 4.25" Diameter Bottles, PRS-832

Ordering Information – Transportable Accessories

Part Number	Descrition	Dimensions	Weight
PRS-CC2	Carrying Case for D103 Transportable Cylinders	8.5" x 4.5" x 23"	2.5 lb
PRS-832	Steel Ring Style Stand for 3.25" to 4.25" Bottles, wall or cart mounted	5" x 5" x 11"	4 lb
PRS-835	Steel Ring Style Stand for 3.25" to 4.25" Diameter Bottles	9" x 9" x 7"	4 lb
PRS-837	Steel Ring Style Stand for 7.0" to 8.75" Diameter Bottles	13" x 13" x 7"	7 lb

Industrial Hygiene

Special Purpose Regulators for Transportable Cylinders

PRAXAIR
Making our planet more productive

400 Series Preset Flow Regulators

The 400 Series regulators are for use with transportable D(17) and D(34) (17 and 34 liter) non-refillable cylinders using a CGA 600 valve. These single stage, piston style regulators are designed for non-corrosive service. The control valve permits constant gas flow and easy on/off capability. Each regulator comes with a cylinder pressure gauge and is available in five preset flow ranges.

Features

- Piston Type Construction
- Preset Flow Ratings
- On/Off Valve
- 1-1/2" x 700 psig gauge

Specifications

- **Maximum Inlet Pressure**
  500 psig
- **Temperature Operating Range**
  0 °F to 140 °F
  (-18 °C to 60 °C)
- **Outlet Flow Settings (Orifice)**
  0.25, 0.3, 0.5, 1.0, and 1.5 Lpm
- **Inlet Fitting**
  CGA 600
- **Outlet Fitting**
  3/16" Hose barb

Materials

- **Body**
  Brass barstock
- **Spring Housing Cap**
  Chrome-plated brass
- **Seat**
  Teflon®
- **Piston**
  Brass
- **Piston "O" Rings**
  BUNA-N®

Ordering Information – 400 Series

Part Number	Flow Rate
PRS413	0.25 slpm Air
PRS414	0.30 slpm Air
PRS417	0.5 slpm Air
PRS418	1.0 slpm Air
PRS411	1.5 slpm Air

500 Series Preset Flow Regulators

The 500 Series regulators are for use with transportable D(34A), D(58), D(76) and D(103) (34, 58, 76 and 103 liter) non-refillable cylinders. These single stage, piston style regulators are designed for non-corrosive gas service and have proven to be satisfactory for use with low level corrosive gases (less than 100 ppm)*. The control valve permits constant gas flow and easy on/off capability. Each regulator comes with a cylinder pressure gauge and is available in seven preset flow ranges. This series of regulators is for use with non-refillable cylinders using a 5/8" – 1/8 UNF C-10 valve.

* Low level corrosive gases slowly react with the "wetted" brass parts of the 500 Series regulators. In order to minimize loss of calibration accuracy, the regulator must be removed from the cylinder after each use. The 6000 Series regulator (page D•189) is recommended for extended use with corrosive gas calibration standards.

Features

- Piston Type Construction
- Preset Flow Ratings
- On/Off Valve
- 1-1/2" x 1200 psig gauge

Specifications

- **Maximum Inlet Pressure**
  1000 psig
- **Temperature Operating Range**
  0 °F to 140 °F
  (-18 °C to 60 °C)
- **Outlet Flow Settings (Orifice)**
  0.25, 0.3, 0.5, 1.0, and 1.5, 2.5, and 6.0 Lpm
- **Inlet Fitting**
  5/8" – 18 unf (C-10)
- **Outlet Fitting**
  3/16" Hose barb

Materials

- **Body**
  Brass barstock
- **Spring Housing Cap**
  Chrome-plated brass
- **Seat**
  Teflon®
- **Piston**
  Brass
- **Piston "O" Rings**
  BUNA-N®

Ordering Information – 500 Series

Part Number	Flow Rate
PRS514	0.25 slpm Air
PRS516	0.30 slpm Air
PRS517	0.50 slpm Air
PRS518	1.0 slpm Air
PRS511	1.5 slpm Air
PRS512	2.5 slpm Air
PRS515	6.0 slpm Air

Industrial Hygiene

Special Purpose Regulators for Transportable Cylinders

6000 Series Multiflow Regulators

The 6000 Series regulators are for use with transportable D(58), D(103) and D(221) (58, 103 and 221 liter) non-refillable cylinders and can be configured for use with high pressure refillable cylinders. These aluminum single stage piston style regulators are recommended for applications requiring a fixed rate. Their aluminum construction is compatible with a wide range of pure gases and mixtures, including hydrogen sulfide, nitric oxide and sulfur dioxide. The regulator has eight flow settings ranging from 0.2 to 6 liters per minute. It is available with either a stainless steel or brass gauge and your choice of CGA connections. Gauges are 1,000 psig for non-refillable cylinders or 3,000 psig for high pressure refillable cylinders.

Features

- Piston Type Construction
- Preset Flow Ratings
- 1-1/2" x 1000 or 3000 psig gauge

Specifications

- **Maximum Inlet Pressure** 2000 psig
- **Temperature Operating Range** 0 °F to 140 °F (-18 °C to 60 °C)
- **Outlet Flow Settings (Orifice)** 0.3, 0.5, 1.0, 1.5, 2.0, 2.5, 3.0, 5.0, 6.0, 7.0 and 8.0 Lpm
- **Inlet Fitting** 5/8" – 18 unf (C-10) or specified CGA
- **Outlet Fitting** 3/16" Hose barb

Materials

- **Body** Aluminum
- **Spring Housing Cap** Aluminum
- **Nozzle** Aluminum
- **Seat** KEL-F®
- **Inboard Filter** 50 micron sintered stainless steel
- **Pressure Adjusting Spring** Heat-treated mild steel wire

Ordering Information — 6000 Series

Part Number	Description
PRS6C10N	Regulator for 103 liter cylinder, brass gauge, 1000 psig
PRS6C10R	Regulator for 58 liter cylinder, SS gauge, 1000 psig
PRS6165	Regulator with CGA 165 inlet, 1000 psig
PRS6590	Regulator with CGA 590 inlet, 3000 psig
PRS6330	Regulator with CGA 330 inlet, 3000 psig

8000 Series Pressure Demand Regulators

The 8000 Series pressure demand regulators are for use with transportable D(58) and D(103) (58 and 103 liter) non-refillable cylinders and can be configured for use with refillable cylinders. This regulator is designed to automatically provide the correct flow of gas to instruments that have internal pumps for introducing calibration gas into the instrument. Typical activation suction is from 0 to 3 inches of water, which conveniently matches the requirements for the many different portable gas monitors on the market. The 8000 Series can be configured for cylinders with supply pressures of 500 psig to 1000 psig. The body of the regulator is nickel plated brass, has an aluminum bonnet and features Viton® as the seating material for reactive gases. The aluminum and nickel plated brass are compatible with a wide range of pure gases and mixtures, including hydrogen sulfide, nitric oxide and sulfur dioxide. This regulator features an outlet fitting which is a 3/16" hose barb.

The 8660 Series pressure demand regulator is for use with the CGA 660 outlet connection and high pressure refillable cylinders. It features a gauge available in stainless steel for reactives or brass for non-reactives, with a pressure range of 0 to 3000 psig.

Features

- Flow Dependent on Instrument Demand
- Variable Flow Ratings
- 1000 or 3000 psig gauge

Specifications

- **Maximum Inlet Pressure** 2000 psig
- **Temperature Operating Range** 0 °F to 140 °F (-18 °C to 60 °C)
- **Inlet Fitting** 5/8" – 18 UNF (C-10) or CGA 330 or CGA 660
- **Outlet Fitting** 3/16" Hose barb
- **Outlet Flow Settings** Variable, matches instrument requirement Flow range, .25 to 3 Lpm

Materials

- **Body** Nickel plated brass
- **Bonnet** Aluminum
- **Seat and Seals** Viton® and Teflon®
- **Gauges** 0-1000 psig for C-10 fittings 0-3000 psig for CGA 330 and CGA 660

Ordering Information – 8000 Series

Part Number	Description
PRS8C10N	Regulator for 103 liter cylinder, brass gauge, 1000 psi
PRS8C10R	Regulator for 58 liter cylinder, SS gauge, 1000 psig
PRS8580	Regulator with CGA 580 inlet, 3000 psig
PRS8590	Regulator with CGA 590 inlet, 3000 psig
PRS8330	Regulator with CGA 330 inlet, 3000 psig
PRS8660	Regulator with CGA 660 inlet, 3000 psig

Industrial Hygiene

Transportable Cylinders – Pure Gases

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Making our planet more productive

Steel cylinders are for use with pure gases such as argon, helium and nitrogen. Whatever the requirement, Praxair has just the right package for your field calibration needs.

Pure Gases

Product Description	Product Grade	Quality Assay	Contents/Cylinder Style				
			17 L	34 L	103 L	221 L	550 L
Air	Zero Zero, HC Hydrocarbon Free		D17	D34	D103 D103	D221 D221	D550
Argon	4.8	99.998%	D17	D34	D103	D221	D550
Carbon Dioxide	4.0	99.99%			D103		
Helium	4.5	99.995%	D17	D34	D103	D221	D550
Hydrogen	4.0	99.99%	D17	D34			
Methane	2.0	99.99%	D17	D34			
Nitrogen	4.8 Zero 5.0	99.998% 99.999%	D17	D34	D103 D103	D221	D550
Oxygen	4.0	99.99%			D103		
Propane	2.5	99.5%	D17				

Praxair's complete line of steel and aluminum transportable cylinders

Industrial Hygiene

Transportable Cylinders – Non-Reactive Gas Mixtures

Steel cylinders are for use with non-reactive gas mixtures. Whatever the requirement, Praxair has just the right package for your field calibration needs.

Gas mixtures can be certified up to ± 2% analytical uncertainty.

Non-Reactive Gas Mixtures

Mixture Components	Balance Gas	Contents/Cylinder Style				
		17 L	34 L	103 L	221 L	550 L
Butane C_4H_{10}						
25% LEL - 50 % LEL C4H10	Air	D17	D34	D103		
8% C_4H_{10}	Nitrogen	D17				
Carbon Dioxide CO_2						
1.0% CO_2	Air			D103		
100-200 ppm CO_2	Nitrogen			D103		
500 ppm CO_2	Nitrogen	D17				
700 ppm CO_2	Nitrogen	D17	D34			
800 ppm CO_2	Nitrogen	D17				
1000 ppm CO_2	Nitrogen	D17	D34	D103	D221	
2000 ppm CO_2	Nitrogen	D17		D103	D221	
5000 ppm CO_2	Nitrogen				D221	
2.5% CO_2	Nitrogen			D103		
5% CO_2	Nitrogen		D34	D103	D221	
10% CO_2	Nitrogen			D103		
Carbon Monoxide CO						
10 ppm CO	Air	D17	D34	D103		
20 ppm CO	Air	D17	D34	D103		D550
25 ppm CO	Air	D17	D34	D103	D221	
35-40 ppm CO	Air	D17	D34	D103		
50 ppm CO	Air	D17	D34	D103	D221	D550
60-80 ppm CO	Air	D17	D34	D103		
100 ppm CO	Air	D17	D34	D103	D221	D550
150 ppm CO	Air		D34	D103		
200 ppm CO	Air	D17	D34	D103		
250 ppm CO	Air	D17	D34	D103		D550
300-400 ppm CO	Air	D17	D34	D103		
500 ppm CO	Air			D103		
50 ppm CO	Nitrogen	D17	D34	D103	D221	
60 ppm CO	Nitrogen			D103		
80 ppm CO	Nitrogen			D103		
100 ppm CO	Nitrogen	D17	D34	D103	D221	
200 ppm CO	Nitrogen	D17	D34	D103		
400-1000 ppm CO	Nitrogen			D103		
CarbonMonoxide CO, Carbon Dioxide CO_2						
1000 ppm CO/CO_2 50 ppm	Air			D103		
Carbon Monoxide CO, Carbon Dioxide CO_2, Oxygen O_2						
4000 ppm CO/CO_2 30%/O_2 1000 ppm	Nitrogen	D17				
Carbon Monoxide CO, Methane CH_4						
50 ppm CO/Methane 50% LEL	Air	D17	D34	D103		

Typical concentrations noted. Inquire for other mixtures and styles.

Industrial Hygiene

Transportable Cylinders – Non-Reactive Gas Mixtures

PRAXAIR
Making our planet more productive

Steel cylinders are for use with non-reactive gas mixtures. Whatever the requirement, Praxair has just the right package for your field calibration needs.

Gas mixtures can be certified up to ± 2% analytical uncertainty.

Non-Reactive Gas Mixtures, *continued*

Mixture Components	Balance Gas	Contents/Cylinder Style				
		17 L	34 L	103 L	221 L	550 L
Carbon Monoxide CO, Methane CH_4, Oxygen O_2						
35 ppm CO/Methane 10% LEL/O_2 18%	Nitrogen	D17				
50-60 ppm CO/Methane 50% LEL/O_2 12%-19 %	Nitrogen			D103		
200 ppm CO/Methane 50% LEL/O_2 19.5%	Nitrogen		D34			
200 ppm CO/Methane 50% LEL/O_2 20%	Nitrogen	D17	D34			
250 ppm CO/Methane 50% LEL/O_2 17%	Nitrogen			D103		
Carbon Monoxide CO, Propane C_3H_8, Oxygen O_2						
60 ppm CO/Propane 30% LEL/O_2 15%	Nitrogen			D103		
Carbon Monoxide CO, Pentane C_5H_{12}, Oxygen O_2						
50 ppm CO/Pentane 25% LEL/O_2 19%	Nitrogen					D550
100 ppm CO/Pentane 25% LEL/O_2 19%	Nitrogen		D34	D103		
Ethylene C_2H_4						
12-27 ppm C_2H_4	Air	D17				
1.15% C_2H_4	Air			D103		
Helium He						
Helium 10%	Nitrogen					D550
Hexane C_6H_{14}						
25-50 ppm C_6H14	Air	D17	D34	D103	D221	
75 ppm C_6H_{14}	Air	D17	D34		D221	
100 ppm C_6H_{14}	Air	D17	D34	D103	D221	
400 ppm C_6H_{14}	Air	D17	D34			
500 ppm C_6H_{14}	Air	D17	D34	D103		
10% LEL-25 % LEL C_6H_{14}	Air	D17	D34	D103		
26% LEL C_6H_{14}	Air			D103		
30% LEL C_6H_{14}	Air	D17	D34	D103		
40% LEL C_6H_{14}	Air	D17	D34	D103	D221	
Hydrogen H_2						
100 ppm H_2	Air			D103		
500 ppm H_2	Air			D103		
1000 ppm H_2	Air			D103		
2000 ppm H_2	Air	D17				
20% LEL H_2	Air	D17	D34	D103		
25% LEL H_2	Air	D17	D34	D103		
40% LEL H_2	Air	D17				
50% LEL H_2	Air	D17	D34	D103	D221	
Hydrogen H_2						
8000 ppm H_2	Nitrogen			D103		
2% H_2	Nitrogen				D221	
8% H_2	Nitrogen		D34			
Methane CH_4						
60% LEL CH_4	Nitrogen			D103		
20%-50% by volume CH_4	Nitrogen	D17				

Typical concentrations noted. Inquire for other mixtures and styles.

Non-Reactive Gas Mixtures, *continued*

Mixture Components	Balance Gas	Contents/Cylinder Style				
		17 L	34 L	103 L	221 L	550 L
Methane CH_4						
10 ppm CH_4	Air	D17		D103	D221	
50 ppm CH_4	Air	D17		D103		
75 ppm CH_4	Air	D17				
95-100 ppm CH_4	Air	D17		D103		
200-1000 ppm CH_4	Air			D103		
20% LEL CH_4	Air	D17	D34	D103	D221	
25% LEL - 30% LEL CH_4	Air			D103		
40% LEL CH_4	Air	D17		D103	D221	
50% LEL CH_4	Air	D17	D34	D103	D221	D550
55% LEL CH_4	Air	D17				
58% LEL CH_4	Air			D103	D221	
60% LEL CH_4	Air	D17		D103		
Methane CH_4, Carbon Dioxide CO_2						
15%-50% by Volume	Nitrogen	D17				
CH_4/CO_2 15%-35 % by Volume						
Methane CH4, Oxygen O_2						
29% LEL CH_4/O_2 15%	Nitrogen	D17		D103		
50% LEL CH_4/O_2 17%	Nitrogen		D34			
Oxygen O_2						
0.2% O_2	Nitrogen			D103		
0.4% O_2	Nitrogen	D17	D34	D103		D550
0.5% O_2	Nitrogen			D103		
1.0 % O_2	Nitrogen	D17	D34	D103	D221	
2.0% O_2	Nitrogen	D17	D34	D103	D221	D550
4.0% O_2	Nitrogen	D17	D34	D103	D221	
5.0%-8% O_2	Nitrogen	D17	D34	D103		
10.0% O_2	Nitrogen	D17		D103		
17.0%-18 % O_2	Nitrogen	D17	D34	D103		
20.9% O_2	Nitrogen	D17	D34	D103	D221	
Pentane C_5H_{12}						
100 ppm C_5H_{12}	Air	D17				
6.7% LEL C_5H_{12}	Air		D34	D103		
10% LEL C_5H_{12}	Air		D34			
25% LEL C_5H_{12}	Air		D34	D103		
50% LEL C_5H_{12}	Air	D17		D103		
Pentane C_5H_{12}, Oxygen O_2						
25% LEL C_5H_{12}/O_2 19%	Nitrogen		D34			
50% LEL C_5H_{12}/O_2 15%	Nitrogen	D17	D34	D103		
Propane C_3H_8						
20% LEL C_3H_8	Air		D34A	D103		
25% LEL C_3H_8	Air	D17	D34A	D103		
28.5% LEL C_3H_8	Air			D103		
30% LEL - 50% LEL C_3H_8	Air	D17	D34A	D103		
Toluene C_7H_8						
50 ppm C_7H_8	Air	D17	D34	D103		
100-400 ppm C_7H_8	Air	D17	D34	D103		

Typical concentrations noted. Inquire for other mixtures and styles.

Industrial Hygiene

Transportable Cylinders – Reactive Gas Mixtures

PRAXAIR
Making our planet more productive

Aluminum containers suitable for reactive gas mixtures include 76, 58, and 34- liter capacities and are for use with mixtures that are not stable in steel cylinders. Typical components include ammonia, chlorine, hydrogen sulfide, nitric oxide, nitrogen dioxide and sulfur dioxide.

Gas mixtures can be certified up to ± 2% analytical uncertainty.

Reactive Gas Mixtures

Product Description	Balance Gas	Contents/Cylinder Style		
		34 L	58 L	76 L
Ammonia NH_3				
10 ppm-1000 ppm NH_3	Air	D34A	D58	D76
25-50 ppm NH_3	Air	D34A		
100 ppm NH_3	Air		D58	
Ammonia NH_3				
10 ppm NH_3	Nitrogen	D34A	D58	
25-50 ppm NH_3	Nitrogen	D34A	D58	D76
100 ppm NH_3	Nitrogen		D58	D76
125-300 ppm NH_3	Nitrogen		D58	
Benzene C_6H_6				
5-100 ppm C_6H_6	Air		D58	D76
Benzene C_6H_6				
5-100 ppm C_6H_6	Nitrogen		D58	D76
BTEX (Toluene,Benzene, Ethylbenzene, o-Xylene)				
10-20 ppm BTEX	Nitrogen			D76
Carbon Monoxide CO, Propane C_3H_8, Sulfur Dioxide SO_2				
50 ppm CO/Propane 52% LEL/Sulfur Dioxide 10 ppm	Air		D58	
Carbon Monoxide CO, Pentane C_5H_{12}, Sulfur Dioxide SO_2, Oxygen O_2				
50 ppm CO/Pentane 25% LEL/Sulfur Dioxide 5 ppm/O_2 15 %	Nitrogen		D58	
50 ppm CO/Pentane 25% LEL/Sulfur Dioxide 25 ppm/O_2 19 %	Nitrogen		D58	
200 ppm CO/Pentane 50% LEL/Sulfur Dioxide 25 ppm/O_2 20%	Nitrogen		D58	
Chlorine Cl_2				
5-10 ppm Cl_2	Nitrogen	D34A	D58	
Ethylene Oxide ETO				
5-50 ppm ETO	Nitrogen		D58	
Hydrogen Cyanide HCN				
5-20 ppm HCN	Nitrogen		D58	
Hydrogen Sulfide H_2S				
5 ppm H_2S	Air		D58	
10 ppm H_2S	Air	D34A	D58	D76
20 ppm H_2S	Air		D58	
25 ppm H_2S	Air	D34A	D58	D76
40 ppm H_2S	Air		D58	
50 ppm H_2S	Air	D34A	D58	
100 ppm H_2S	Air		D58	

Typical concentrations noted. Inquire for other mixtures and styles.

Reactive Gas Mixtures, *continued*

Product Description	Balance Gas	Contents/Cylinder Style		
		34 L	58 L	76 L
Hydrogen Sulfide H_2S				
5 ppm H_2S	Nitrogen		D58	
10 ppm H_2S	Nitrogen	D34A	D58	D76
20 ppm H_2S	Nitrogen		D58	
25 ppm H_2S	Nitrogen	D34A	D58	D76
30-35 ppm H_2S	Nitrogen		D58	
40 ppm H_2S	Nitrogen		D58	D76
50 ppm H_2S	Nitrogen	D34A	D58	D76
60-90 ppm H_2S	Nitrogen		D58	
100 ppm H_2S	Nitrogen		D58	D76
Hydrogen Sulfide H_2S, Carbon Monoxide CO, Methane CH_4				
25 ppm H_2S/CO 50-100 ppm/Methane 50% LEL	Air	D34A	D58	
Hydrogen Sulfide H_2S, Carbon Monoxide CO, Methane CH_4, Oxygen O_2				
10 ppm H_2S/CO 35 ppm/Methane 10% LEL/O_2 18%	Nitrogen		D58	
10 ppm H_2S/CO 50 ppm/Methane 50% LEL/O_2 20.9%	Nitrogen	D34A		
10 ppm H_2S/CO 300 ppm/Methane 50% LEL/O_2 15%	Nitrogen	D34A		
25 ppm H_2S/CO 50 ppm/Methane 50% LEL/O_2 12%	Nitrogen	D34A	D58	D76
25 ppm H_2S/CO 50 ppm/Methane 50% LEL/O_2 17-18 %	Nitrogen		D58	
25 ppm H_2S/CO 50 ppm/Methane 50% LEL/O_2 19%	Nitrogen	D34A	D58	
25 ppm H_2S/CO 95-100 ppm/Methane 30% LEL - 50 % LEL/O_2 13 %-20.9 %	Nitrogen		D58	
40 ppm H_2S/CO 100 ppm/Methane 50% LEL/O_2 15%	Nitrogen	D34A		
Hydrogen Sulfide H_2S, Carbon Monoxide CO, Pentane C_5H_{12}, Oxygen O_2				
10 ppm H_2S/CO 35 ppm/Pentane 10% LEL/O_2 18%	Nitrogen		D58	
10 ppm H_2S/CO 60 ppm/Pentane Sim. 58% LEL/O_2 15%	Nitrogen		D58	
10 ppm H_2S/CO 300 ppm/Pentane Sim. 58% LEL/O_2 15%	Nitrogen	D34A	D58	D76
20 ppm H_2S/CO 60 ppm/Pentane Sim. 58% LEL/O_2 15%	Nitrogen	D34A		
25 ppm H_2S/CO 50 ppm/Pentane 25% LEL/O_2 19%	Nitrogen		D58	D76
25 ppm H_2S/CO 50 ppm/Pentane 50% LEL/O_2 19%	Nitrogen		D58	
25 ppm H_2S/CO 50 ppm/Pentane 50% LEL/O_2 20.9%	Nitrogen	D34A		
25 ppm H_2S/CO 100 ppm/Pentane 25% LEL/O_2 19%	Nitrogen	D34A	D58	D76
25 ppm H_2S/CO 200 ppm/Pentane 25% LEL/O_2 19%	Nitrogen		D58	
Hydrogen Sulfide H_2S, Carbon Monoxide CO, Propane C_3H_8, Oxygen O_2				
25 ppm H_2S/CO 50 ppm/Propane 50% LEL/O_2 18%	Nitrogen	D34A	D58	
25 ppm H_2S/CO 50 ppm/Propane Sim. 50% LEL/O_2 18%	Nitrogen	D34A		
25 ppm H_2S/CO 50 ppm/Propane 50% LEL/O_2 19%	Nitrogen		D58	
Hydrogen Sulfide H_2S, Carbon Monoxide CO,/Pentane C_5H_{12}				
25 ppm H_2S/CO 50-100 ppm/Pentane 50% LEL/Air	Air		D58	

Typical concentrations noted. Inquire for other mixtures and styles.

Industrial Hygiene

Transportable Cylinders – Reactive Gas Mixtures

PRAXAIR
Making our planet more productive

Aluminum containers suitable for reactive gas mixtures include 76, 58, and 34- liter capacities and are for use with mixtures that are not stable in steel cylinders. Typical components include ammonia, chlorine, hydrogen sulfide, nitric oxide, nitrogen dioxide and sulfur dioxide.

Gas mixtures can be certified up to ± 2% analytical uncertainty.

Reactive Gas Mixtures, *continued*

Product Description	Balance Gas	Contents/Cylinder Style		
		34 L	58 L	76 L
Hydrogen Sulfide H_2S, Carbon Monoxide CO, Propane C_3H_8				
25 ppm H_2S/CO 50 ppm/Propane 50% LEL	Air	D34A	D58	
Hydrogen Sulfide H_2S, Methane CH_4				
25 ppm H_2S/Methane 50% LEL	Air	D34A	D58	
Hydrogen Sulfide H_2S, Methane CH_4, Oxygen O_2				
25 ppm H_2S/Methane 50% LEL/O_2 18%	Nitrogen		D58	
Hydrogen Sulfide H_2S, Pentane C5H10, Oxygen O_2				
25 ppm H_2S/Pentane 50% LEL/O_2 16%	Nitrogen		D58	
Nitric Oxide NO				
5 ppm NO	Nitrogen		D58	D76
10 ppm NO	Nitrogen	D34A	D58	D76
12 ppm NO	Nitrogen		D58	
25 ppm NO	Nitrogen	D34A	D58	D76
30 ppm NO	Nitrogen		D58	
50 ppm NO	Nitrogen	D34A	D58	D76
80-800 ppm NO	Nitrogen		D58	
Nitrogen Dioxide NO_2				
5 ppm NO_2	Air		D58	D76
10 ppm NO_2	Air	D34A	D58	D76
25 ppm NO_2	Air	D34A	D58	
30 ppm NO_2	Air		D58	
50 ppm NO_2	Air	D34A	D58	
5 ppm NO_2	Nitrogen		D58	D76
10 ppm NO_2	Nitrogen	D34A	D58	D76
25 ppm NO_2	Nitrogen	D34A	D58	
30 ppm NO_2	Nitrogen		D58	
50 ppm NO_2	Nitrogen	D34A	D58	
Sulfur Dioxide SO_2				
5 ppm SO_2	Air		D58	D76
10 ppm SO_2	Air	D34A	D58	
25 ppm SO_2	Air	D34A	D58	D76
5 ppm SO_2	Nitrogen		D58	D76
10 ppm SO_2	Nitrogen	D34A	D58	D76
20 ppm SO_2	Nitrogen		D58	
25 ppm SO_2	Nitrogen	D34A	D58	D76
35 ppm SO_2	Nitrogen		D58	
50 ppm SO_2	Nitrogen	D34A	D58	

Typical concentrations noted. Inquire for other mixtures and styles.

Industrial Hygiene

PortaGas

PortaGas™ is the newest member to the Praxair family of Industrial Hygiene gases. *Portagas* products bring innovative leadership in calibration gases and regulators.

PortaGas products are 100% focused on the Industrial Hygiene, Environmental and Safety industry. *Portagas* products bring over 20 plus years of commitment to developing a winning combination of quality products, outstanding service, and timely delivery. We recognize the importance of offering quality gas mixtures that meet the high accuracy and traceability for NIST – The National Institute of Standards and Technology.

The *PortaGas* lines newest game changing innovation features the newly designed line of *PortaGreen*™ cylinders. This line features a newly designed, reusable, sustainable, and recyclable cylinder program. Each *PortaGreen* cylinder is manufactured with the complete capabilities and expressed intention of being reused by Praxair to deliver calibration gas with a low return rate and long shelf life.

Packaging the new *PortaGreen* cylinder line in Praxair's convenient, easy to use, *Strip & Ship*™ return program has many benefits. Each individually bar coded, NIST traceable, gas filled cylinder makes its way through Praxair's fully automated ISO 9001/2008 certified manufacturing process. Each cylinder is individually QC'd on Praxair's custom gas analyzer system prior to shipment.

The *PortaGreen Strip & Ship* recyclable program is designed to make cylinder return effortless and is available in the standard four sizes (34L/58L/100L/116L). Safety symbols, visual and written instructions are printed on each cylinder for making the return back to Praxair convenient.

Industrial Hygiene

PortaGreen Cylinders

PRAXAIR
Making our planet more productive

34L *58L* *100L* *116L*

Cylinder	34 Gallon	58 Gallon	100 Gallon	116 Gallon
Gas Contents	34 Liters	58 Liters	100 Liters	116 Liters
Pressure	985 psi	1000 psi	1000 psi	1000 psi
Connection	C-10 5/8" – 18 UNF	C-10 5/8" – 18 UNF	C-10 5/8" – 18 UNF	C-10 5/8" – 18 UNF
Material of Construction	Aluminum	Aluminum	Aluminum	Aluminum
Weight	.99 LBS	1.43 LBS	2.4 LBS	3.74 LBS
Dimensions	2.5" x 9.5"	2.9" x 10.8"	3.5" x 12"	3.5" x 13.5"
Cylinder Compliance	ISO7866	ISO7866	ISO7866	ISO7866
Regulator	Series 100	Series 100	Series 100	Series 100

PortaGreen™: Innovative and sustainable cylinders. Easy and safe return process.

PortaGreen is our line of recyclable and sustainable gas cylinders. Available in four sizes, the *PortaGreen* cylinders are more compact than standard cylinders and can be conveniently returned using our exclusive *Strip & Ship* program.

The *Strip & Ship* program reduces the work – and the cost – associated with standard cylinder disposal. For each empty cylinder, just follow these quick simple three steps.

Step 1

Make sure gauge reads zero

Step 2

Strip off content label layer to reveal return label

Step 3

Place in tube for return shipping

Pure Gases

Product Description	Product Grade	Quality Assay	34L	58L	100L	116L
Air	Zero		90100904	90301369	90095149	90100913
Carbon Dioxide		99.99%		90303080	10019000	
Nitrogen		99.99%	90097246	90098794	10468479	
Nitrogen		99.999%		90100890	90091751	90101257

Preset Constant Flow Regulators – 100 Series

Designed to maintain constant flow rates so you get accurate monitor calibrations even as the cylinder pressure drops.

The 100 Series regulators feature:

- A unique serial number traceable to N.I.S.T.
- Knurled on/off knob for easy grip
- Passivated surfaces that help prevent reaction with calibration gas
- Diaphragm design that allows a constant pressure flow, even as the cylinder volume and pressure are depleted
- No set screw on knob to strip out
- Finer graduations for precise level readings
- Stainless steel gauge
- Wide choice of outlets and inlets available
- Side outlet prevents tubing from kinking

100 Series Regulator

Economy Regulator

In addition to our 100 series regulator, Praxair also offers an economy regulator for use with calibration gases.

Industrial Hygiene

PortaGas Cylinders – Non-Reactive Gas Mixtures

PRAXAIR
Making our planet more productive

Non-Reactive Gas Mixtures

Mixture Components	Balance Gas	34L	58L	100L	116L
Benzene 5 ppm	Air	90099764	10008501	90094898	90301579
Carbon Dioxide 2.5%	Air	90100608	90403722	10044500	90302081
Carbon Dioxide 2.5%	Nitrogen		90092022	90302309	90301517
Carbon Dioxide 5%	Nitrogen	90101297		90302267	90301670
Carbon Dioxide 5000 ppm	Nitrogen	90302242		10037000	90301561
Carbon Monoxide 20 ppm	Air	90100905	90100500	10100000	
Carbon Monoxide 50 ppm	Air	90303053	90100682	10125000	90101211
Carbon Monoxide 60 ppm, Pentane Equivalent 58% LEL (Methane 1.45%), Oxygen 15%	Nitrogen	90201045	90301481	90094550	90101264
Carbon Monoxide 100 ppm	Air	90098938	10144001	90302065	90301581
Carbon Monoxide 100 ppm, Methane 2.5% (50% LEL)	Air			10144555	
Carbon Monoxide 100 ppm, Methane 2.5% (50% LEL), Oxygen 18%	Nitrogen	90301758	90098930	90098784	90301519
Carbon Monoxide 100 ppm, 19% Methane 2.5% (50% LEL), Oxygen	Nitrogen	90302198		90302049	
Carbon Monoxide 100 ppm, Pentane 3500 PPM (25% LEL), Oxygen 19%	Nitrogen	90302112		10144578	90301695
Carbon Monoxide 200 ppm	Air		90302304	90302207	90101169
Carbon Monoxide 250 ppm, Carbon Dioxide 2.5%, Methane 2.5% (50% LEL), Oxygen 18%	Nitrogen			90402978	
Carbon Monoxide 300 ppm	Air		90302965	10185000	90101212
Carbon Monoxide 300 ppm	Nitrogen		90402864	10194000	90101263
Carbon Monoxide 500 ppm	Air			10195010	90101083
Hydrogen 500 ppm	Air		90301468	10314505	90301593
Hydrogen 2% (50% LEL)	Air	90100541	90302199	10319900	90301591
Iso-Butane 0.9% (50% LEL)	Air	90100795		90098474	90301816
Iso-Butylene 100 ppm	Air	90098585	90098789	10373000	90100921
Methane 500 ppm	Air		90098034	90091944	90302184
Methane 2.5% (50% LEL)	Air	90099054	90100507	10444000	90100922
Methane 2.5% (50% LEL), Oxygen 18%	Nitrogen	90100233	90100553	90092147	90101056
Oxygen 20.9%	Nitrogen	90100599	10582090	10582600	90301584
Pentane Equivalent 58% LEL (Methane 1.45%), Oxygen 15%	Nitrogen	90402943	90301524	90094551	
Pentane 3500 ppm (25% LEL), Oxygen 19%	Nitrogen			90302183	
Propane 0.55% (25% LEL)	Air			90095185	
Propane 0.6% (29% LEL)	Air			90092353	
Propane 1.06% (50% LEL)	Air		90302982	10624200	90301582

Reactive Gas Mixtures

Mixture Components	Balance Gas	34L	58L	116L
Ammonia 25 ppm	Air	90094745	10005501	90301436
Ammonia 25 ppm	Nitrogen	90094893	10005300	90100706
Ammonia 50 ppm	Air	90094894	10005003	90101081
Ammonia 50 ppm	Nitrogen	90094611	10005475	90100417
Chlorine 2 ppm	Nitrogen	90094703	10216000	90301680
Chlorine 5 ppm	Nitrogen	90094612	10217100	90201296
Chlorine 10 ppm	Nitrogen	90094746	10218000	90100710
Ethylene Oxide 10 ppm	Nitrogen	90099914	10266663	90301310
Hydrogen Chloride 10 ppm	Nitrogen	90099797	90097257	90301583
Hydrogen Cyanide 10 ppm	Nitrogen	90094700	10320254	90100966
Hydrogen Cyanide 20 ppm	Nitrogen	90101121	10320260	90101262
Hydrogen Sulfide 10 ppm	Nitrogen	90094752	10322000	90100684
Hydrogen Sulfide 20 ppm	Nitrogen	90094904	10326000	90100954
Hydrogen Sulfide 25 ppm	Air	90095747	10327000	90301395
Hydrogen Sulfide 25 ppm	Nitrogen	90094579	10328000	90099311
Hydrogen Sulfide 40 ppm	Nitrogen	90094750	10330000	90100955
Hydrogen Sulfide 50 ppm	Air	90096522	10331000	90101198
Hydrogen Sulfide 50 ppm	Nitrogen	90099085	10332000	90301338
Hydrogen Sulfide 10 ppm, Carbon Monoxide 50 ppm, Methane 2.5% (50% LEL), Oxygen 18%	Nitrogen	90099056	90098413	90101194
Hydrogen Sulfide 10 ppm, Carbon Monoxide 300 ppm, Methane 1.45% (29% LEL), Oxygen 15%	Nitrogen	90094760	90091939	90100925
Hydrogen Sulfide 10 ppm, Carbon Monoxide 300 ppm, Pentane Equivalent 58% LEL (Methane 1.45%), Oxygen 15%	Nitrogen	90098573	90095767	
Hydrogen Sulfide 10 ppm, Carbon Monoxide 300 ppm, Pentane 8100 PPM (58% LEL), Oxygen 15%	Nitrogen		90100642	
Hydrogen Sulfide 10 ppm, Carbon Monoxide 50 ppm, Methane 2.5% (50% LEL), Oxygen 20.9%	Nitrogen	90096872	90095078	90301659
Hydrogen Sulfide 20 ppm, Carbon Monoxide 60 ppm, Methane 1.45% (29% LEL), Oxygen 15%	Nitrogen	90099528	90096995	90302350
Hydrogen Sulfide 20 ppm, Carbon Monoxide 60 ppm, Methane 1.45% (29% LEL), Carbon Dioxide 2.5%, Oxygen 15%	Nitrogen		90302125	90302807
Hydrogen Sulfide 20 ppm, Carbon Monoxide 60 ppm, Methane 2.5% (50% LEL), Oxygen 15%	Nitrogen	90098862	90099467	90301783
Hydrogen Sulfide 20 ppm, Carbon Monoxide 60 ppm, Pentane Equivalent 58% LEL (Methane 1.45%), Oxygen 15%	Nitrogen	90098036	90097884	90100593
Hydrogen Sulfide 20 ppm, Carbon Monoxide 200 ppm, Methane 2.5% (50% LEL), Oxygen 18%	Nitrogen	90100083	90100084	90101047

Industrial Hygiene

PortaGas Cylinders – Reactive Gas Mixtures

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Reactive Gas Mixtures

Mixture Components	Balance Gas	34L	58L	116L
Hydrogen Sulfide 25 ppm, Carbon Monoxide 50 ppm, Methane 2.5% (50% LEL), Oxygen 12%	Nitrogen	90094671	10327785	90101193
Hydrogen Sulfide 25 ppm, Carbon Monoxide 50 ppm, Methane 2.5% (50% LEL), Oxygen 18%	Nitrogen	90098387	10327780	90100484
Hydrogen Sulfide 25 ppm, Carbon Monoxide 50 ppm, Methane 2.5% (50% LEL), Oxygen 20.9%	Nitrogen	90094618	90092114	90100546
Hydrogen Sulfide 25 ppm, Carbon Monoxide 50 ppm, Pentane Equivalent 50% LEL (Methane 1.25%), Oxygen 18%	Nitrogen		90092038	90301421
Hydrogen Sulfide 25 ppm, Carbon Monoxide 50 ppm, Propane Equivalent 50% LEL (Methane 1.25%), Oxygen 18%	Nitrogen	90094670	90091454	90100932
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Methane 2.5% (50% LEL), Oxygen 17%	Nitrogen	90099174	90094762	90302453
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Methane 2.5% (50% LEL), Oxygen 18%	Nitrogen	90096840	10327750	90100504
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Methane 2.5% (50% LEL), Oxygen 19%	Nitrogen	90096649	90094873	90301296
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Methane 2.5% (50% LEL), Oxygen 20.9%	Nitrogen	90096140	90095023	90100930
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Pentane Equivalent 50% LEL (Methane 1.25%), Oxygen 18%	Nitrogen	90098673	90098467	90100963
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Pentane 3500 PPM (25% LEL), Oxygen 18%	Nitrogen	90302674	90302223	90301713
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Pentane 3500 PPM (25% LEL), Oxygen 19%	Nitrogen	90094913	10327765	90100609
Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Propane 1.06% (50% LEL), Oxygen 18%	Nitrogen	90301784	90098458	90301830
Hydrogen Sulfide 40 ppm, Carbon Monoxide 100 ppm, Methane 2.5% (50% LEL), Oxygen 15%	Nitrogen	90096861	90096700	90100709
Nitric Oxide 25 ppm	Nitrogen	90094704	10464780	90302917
Nitric Oxide 50 ppm	Nitrogen	90094754	90094695	90301585
Nitrogen Dioxide 5 ppm	Nitrogen	90094614	10474505	90301276
Nitrogen Dioxide 10 ppm	Nitrogen	90094674	10474545	90301344
Sulfur Dioxide 5 ppm	Nitrogen	90094673	10629000	90301286
Sulfur Dioxide 5 ppm, Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Pentane 3500 ppm (25% LEL), Oxygen 18%	Nitrogen		90302823	90302824
Sulfur Dioxide 10 ppm	Air	90094758	10630000	90301220
Sulfur Dioxide 10 ppm	Nitrogen	90092204	10631000	90100555
Sulfur Dioxide 10 ppm, Hydrogen Sulfide 25 ppm, Carbon Monoxide 100 ppm, Pentane 3500 ppm (25% LEL), Oxygen 18%	Nitrogen			90303107

Institutes of Higher Learning

Overview

Understanding an Institution of Learning's goals and objectives, Praxair delivers a competitive customized offering that will decrease overall cost and provide cost saving opportunities through supply optimization. A local advantage through people, processes, and technology provides solutions that mutually benefit all participants.

Comprehensive Product Range
Supplying each application with the proper gas (grade, compliance, certification, scale).

Superior Reliability
Ensuring high quality products are there when they are needed.

Equipment and Systems Excellence
Connecting customers with everything needed to handle and store gases efficiently and safely.

Productivity and Innovation Partner
Working with learning institutions to identify and implement productivity and cost improvements.

Ease of Doing Business
Providing convenient e-commerce options and strong customer support.

Safety Focus
Making safety the top priority for every activity.

Institutes of Higher Learning

Specialty Gases & Equipment

PRAXAIR
Making our planet more productive

Praxair, North America's largest industrial, medical and specialty gas supplier

As an industry leader Praxair is a full range supplier of liquefied and compressed gases. Once a Praxair Specialist meets with you to discuss your application, volume and pressure requirements the best possible supply mode is determined to deliver exactly what is needed.

Steel and aluminum high or low pressure cylinders

Permanent and transportable cryogenic tanks located at point-of-use

Dry ice is used in many R&D applications for shipping and storing of samples

6, 12 and 18-cylinder gas packs provide the convenience of a large volume supply from cylinders connected to a single manifold

Institutes of Higher Learning

Specialty Gases & Equipment

Improved efficiency with less lab downtime

Praxair's Microbulk gas delivery system is an on-site, cost-effective supply solution that puts the liquids and gases you need right where you need them, creating lab flexibility, efficiency and safety. And with 230L and 265L mobile Microbulk tanks designed specifically for labs just like yours, we've got the gas – from Argon to CO_2 to Nitrogen and Oxygen – and the gas supply you need.

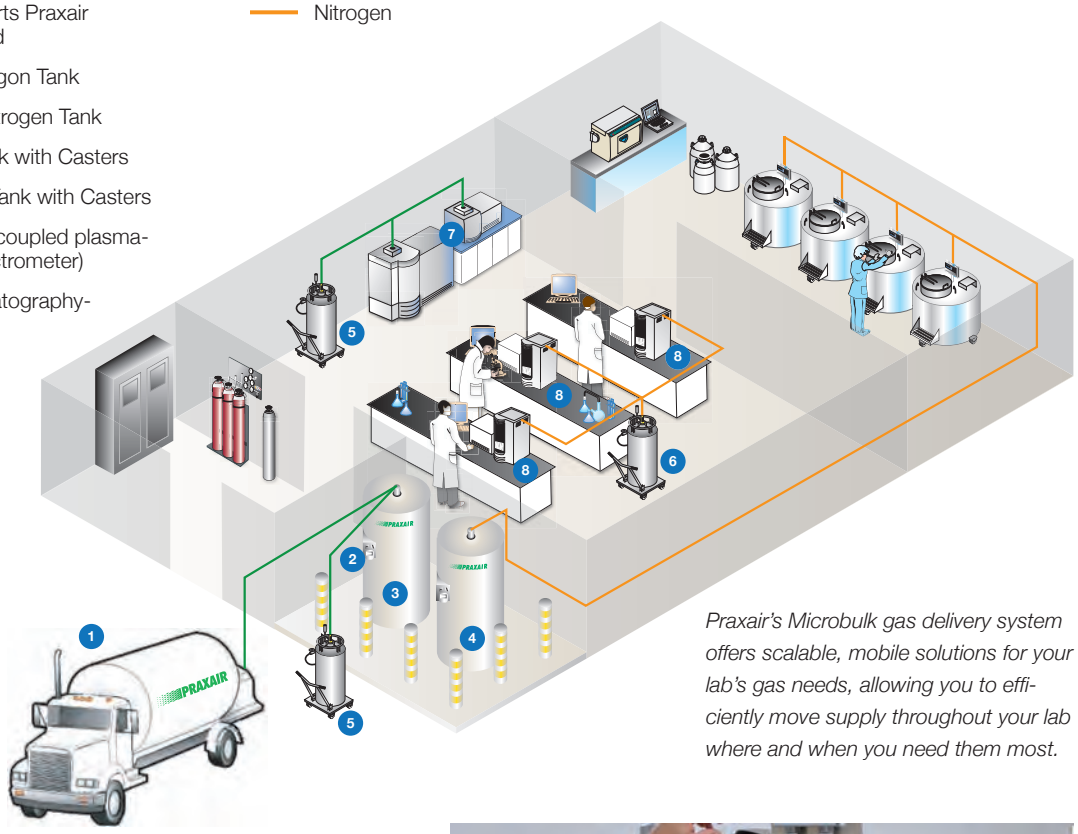
Praxair's patented wireless telemetry system contained within each Microbulk unit monitors your supply levels and automatically generates orders for on-time deliveries. With Microbulk, you can reduce any potential product outages, while ensuring you get all of the gas you pay for.

Perma-Cyl Nitrogen Tank with casters

1. Praxair MicroBulk Truck
2. Telemetry System alerts Praxair when a refill is needed
3. Exterior Stationary Argon Tank
4. Exterior Stationary Nitrogen Tank
5. Perma-Cyl Argon Tank with Casters
6. Perma-Cyl Nitrogen Tank with Casters
7. ICP-AES (inductively coupled plasma-atomic emission spectrometer)
8. LC-MS (liquid chromatography-mass spectrometer)

Argon

Nitrogen



Praxair's Microbulk gas delivery system offers scalable, mobile solutions for your lab's gas needs, allowing you to efficiently move supply throughout your lab where and when you need them most.

On-Site Services and Gas Management

Praxair delivers customized programs that deliver results. We can help you improve cylinder handling safety and provide access to on-site technical advice. Dedicated site management means Praxair will manage cylinder and gas related assets to every use-point on your campus.

Institutes of Higher Learning

Praxair E-Commerce

PRAXAIR
Making our planet more productive

Looking for ideas on how to take cost out of the supply chain management process…Praxair offers a variety of tools that you can choose from.

Praxair Connect is one of the many options that supports Punchout and Hosted Catalogs on leading E-Procurement portals such as SciQuest, Ariba, Oracle, Huboo etc. Level 3 invoicing, EDI and cXML.

For those who do not have a e-Procurement solution in place we have the answer. Praxair Express is an e-Commerce portal that makes transactions easy! Our eCommerce team will assist you with the best solutions to support your needs.

Platform Comparison

Features	Praxair Connect – Hosted Catalog	Praxair Express	Praxair Connect Punchout
Site Features			
Custom Storefront			X
Custom Contact Page			X
Ability to customize checkout process			X
Show contract items only	X		X
Robust product data		X	X
(M)SDS Links		X	X
Favorites Lists		X	X
View hardgoods inventory		X	
Search and compare items	X	X	X
Transactional Features			
EDI document exchange	X		X
Create Requisitions	X		X
No-Touch price updates		X	X
Past Transaction History	X (1)	X	X (1)
Electronic Order-to-Cash	X	X (2)	X
Account Management Features			
View cylinder balance		X	
E-Certificate of Analysis (ECOA)		X	X (3)
Export order history and invoices	X (1)	X	X (1)
View unpaid invoices	X (1)	X	X (1)

(1) Dependent on eProcurement/ERP system
(2) Dependent on payment method
(3) Planned feature

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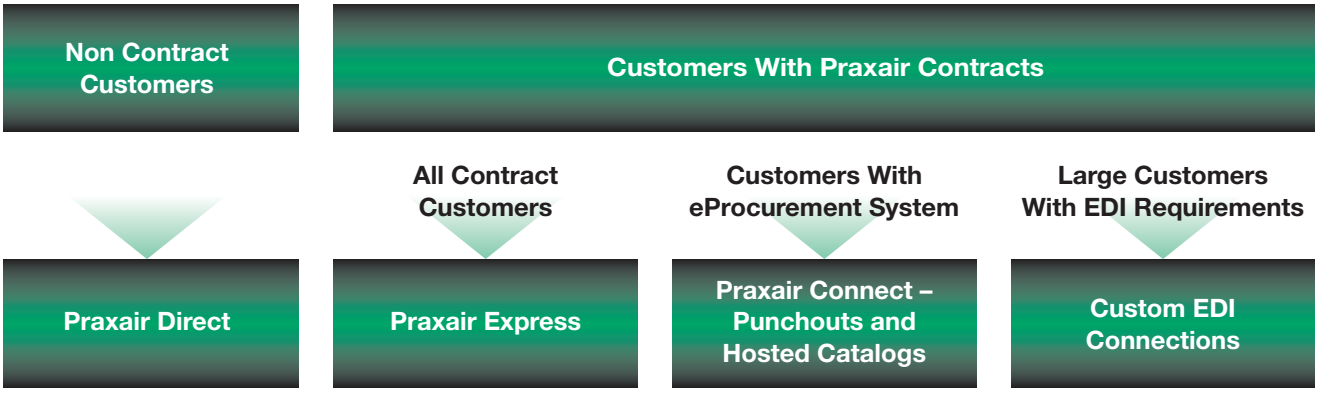
Praxair E-Commerce



Praxair Direct – Shopping and Purchasing for Non-Contract Customers

If you do not have a contract with Praxair you can shop and order online at www.praxairdirect.com.

There you can:

- Browse current product catalogs
- Purchase from a selection of top-tier products
- Find the nearest store and all other contact information.
- Tap into the packaged gas expertise in our online information centers
- Access MSDS, safety, technical and application information
- Read industry news in our current news section.

Praxair Express – Shopping and Purchasing for All Contract Customers

Contract customers can have account management at fingertips.

With Praxair Express you can:

- Place orders with your contract pricing
- Search product availability
- Create custom groups of frequently purchased products
- Request special items
- Search order history
- Review financials and download unpaid invoices
- Download proof of delivery documents
- Check cylinder balances
- Retrieve eCOA and MSDS
- Find a local store

Just register your account at express.praxair.com using your existing account number.

Praxair Connect Punchouts for Contract Customers

For those who have invested in e-procurement systems as part of a strategic sourcing initiative, Praxair can align with your system. Compatible with many leading e-procurement software applications, Praxair Connect delivers a fully customized webstore that is integrated with your ERP system. We'll take care of the maintenance and updating of the site, while you get a webstore that has customized:

- Catalog content
- Contract pricing
- Delivery schedule
- Praxair account information

In addition to customized content, you'll get a first class shopping experience with convenient features like product search and compare, favorites lists, scheduled deliveries and access to Praxair MSDS database. We support PCards and electronic invoicing as part of our electronic order to cash process.

Praxair Connect Hosted Catalogs for Contract Customers

If you have e-procurement in place and prefer to host the catalog yourself, Praxair Connect offers buyer-hosted catalogs.

Our buyer-hosted catalog system is compatible with many leading e-procurement software applications, and delivers a customized catalog integrated with your ERP system.

Your catalog will have your contract pricing, and you will be able to search and compare products. We support PCards and electronic invoicing as part of our electronic order to cash process.

Contact
PraxairConnect@praxair.com

Custom EDI – Electronic Transactions for Contract Customers

If you want to take advantage of electronic services without catalog or shopping capabilities, consider EDI. Using EDI you can securely place orders, receive invoices and make electronic payments. Praxair supports all versions of EDI.

Contact info@praxair.com

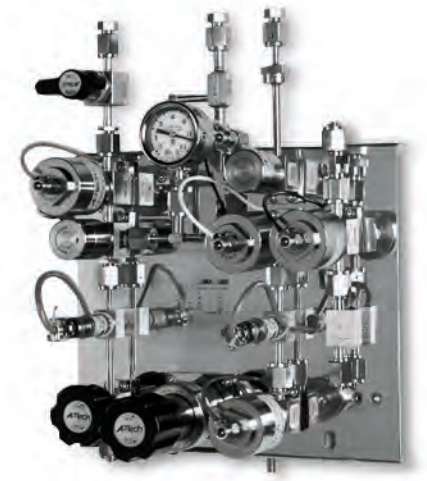
Institutes of Higher Learning

Gas Handling Equipment

PRAXAIR
Making our planet more productive

For your equipment and gas distribution requirements Praxair offers an extensive line of regulators, flowmeters, manifolds, gas distribution panels and cabinets.

From a regulator to a controlled gas cabinet Praxair sells equipment that is designed to keep up with your toughest requirements.



PortaGreen™: Innovative and sustainable cylinders. Easy and safe return process.

PortaGreen is our line of recyclable and sustainable gas cylinders. Available in five sizes, the *PortaGreen* cylinders are morecompact than standard cylinders and can be conveniently returned using our exclusive *Strip and Ship*™ program.

The *Strip and Ship*™ program reduces the work – and the cost – associated with standard cylinder disposal. For each empty cylinder, just follow these quick simple three steps.

Step 1

Make sure gauge reads zero

Step 2

Strip off content label layer to reveal return label

Step 3

Place in tube for return shipping

Institutes of Higher Learning

Services

The *StarWatch*™ Cryogenic Monitoring System

At Praxair we recognize protecting your research is critical. The *StarWatch* gauge helps you improve the monitoring and measurement of the liquid level in cryogenic dewars. Your liquid level and pressure is now electronically displayed. The system can be programmed by the user to alarm at two distinct low liquid level and low pressure settings. Upon alarm, the user is notified by both audible and visible beacons.

The capacitance-based measurement of the *StarWatch* system provides a leap forward in reliability and accuracy versus conventional float gauges.

See page B•87 for more information.

Measurement accuracy of the Praxair StarWatch gauge at +2% coupled with its on-board alarm functionality enables efficient management of cryogenic liquid supply and helps the user mitigate the risk of supply disruptions.

On-Site Survey and Product Usage Analysis

Drives down product cost and administrative duties with gas purchases.

LEAP (Local Emergency Assistance Program)

Through LEAP, Praxair's dedicated safety and environmental services and customer service personnel provide prompt, safe and effective response to emergencies on our customer sites and ensure that every problem is resolved quickly and safely. Praxair will work closely with the EH&S department onsite to promote the safe use and handling of gases and supplies.

Institutes of Higher Learning

Services

PRAXAIR
Making our planet more productive

Facilities and Planning

Looking to expand on campus... our productivity specialist and engineers provide onsite service to assist you with your design and layout helping you make sure that you have the correct piping, manifolds and regulators are critical when working on a facility build-out. Praxair's engineering expertise helps our customers do business more productively and more profitably.

MRI (Magnetic Resonance Imaging)

Praxair is a leading choice of cryogen supplier for MRIs today. From leadership in helium and nitrogen refining, supply to distribution and processing technology Praxair is your complete supplier. To provide optimum cryogen consumption we will work with your staff to regularly monitor your MRI systems.

Storing Biological Specimens

Short and long term storage for your research is critical. Praxair enables cryopreservation applications with a complete portfolio of cryogens, equipment, and services. From a laboratory specimen collection to a major biorepository, our team can implement a complete turn-key liquid nitrogen distribution system that fits any needs. Praxair can supply:

- Vapor-phase freezers, standard liquid-phase freezers, vapor shippers, and all related racking systems and sample handling accessories;
- Cost-effective cryogenic back-up systems for mechanical, compressor-based ultra-low temperature freezers; and
- Factory-trained technicians for freezer installation, start-up, manufacturers recommended maintenance, repair, and emergency service.

Laboratories

Overview

At the heart of every scientific endeavor is a laboratory where the research experiments and analytical procedures are accomplished. For over a hundred years, laboratories have counted on Praxair to fulfill their critical gas needs. Praxair offers a comprehensive range of gas products with the proper purity, compliance, and certification to meet the demands of any laboratory application. Praxair also offers the industry's leading collection of gas handling, distribution, and storage equipment to help lab personnel work safely and productively. Praxair's focus on quality and service gives laboratories the confidence to know that the only variables they need to worry about are in their experiments, not their gases.

Comprehensive Product Range
Supplying each application with the proper gas (grade, compliance, certification, scale).

Superior Reliability
Ensuring high quality products are there when they are needed.

Equipment and Systems Excellence
Connecting customers with everything needed to use, handle, and store gases efficiently and safely.

Productivity and Innovation Partner
Working with laboratories to identify and implement productivity and cost improvements.

Ease of Doing Business
Providing convenient e-commerce options and strong customer support.

Safety Focus
Making safety the top priority for every activity.

PRAXAIR
Making our planet more productive

Equipment and Systems Excellence

Praxair manufactures and supplies thousands of gas handling, storage, and safety solutions:

- regulators
- flow meters
- gas distribution systems
- gas purification accessories
- gas generators and back-up systems
- freezers and cryogenic systems
- valves, fittings, and CGA connections
- gas cabinets
- gas detection and safety equipment

...and much more.

Praxair designs and fabricates all gas distribution systems in-house using high quality components. For laboratories pursuing renovation or expansion, Praxair can design and implement a turn-key build-out.

Protect the purity of your gases and the quality of your lab's results with the right product for the right application.

See Section E for additional information on Praxair's full line of *ProSpec™* gas handling solutions

Multi-Gas Point-of-Use-Panel, see page E•303

5029 Protocol Station, see page E•281

4092 Regulator, see page E•266

Dual Cylinder Rack with Automatic Switch-Over, see page E•297

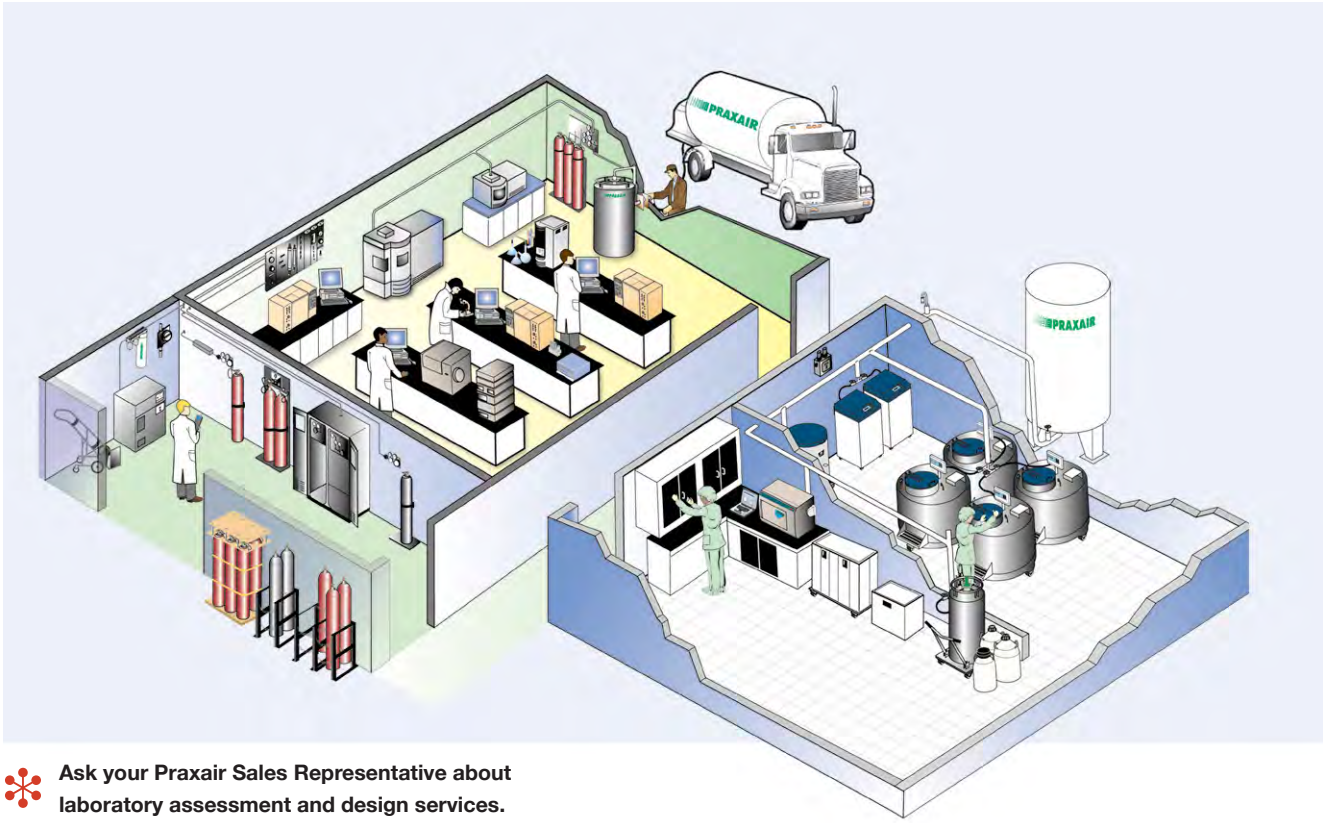
Laboratories

Equipment and Services

Laboratory Assessment Service

Praxair applies its extensive experience with specialty gases and equipment to help laboratory managers and scientists review their gas needs and select the proper gas products and delivery systems. Praxair's Laboratory Assessment Program examines all aspects of gas use, handling, and storage to help laboratories reduce costs and mitigate risk.

Laboratory Assessment Benefits
Achieve consistent work quality
Improve productivity
Optimize supply modes
Protect instrumentation and equipment
Better utilize bench and floor space
Implement appropriate safety measures
Streamline transaction processing
Ensure appropriate product grades and certifications
Improve asset management



Ask your Praxair Sales Representative about laboratory assessment and design services.

We're here to help!

Praxair's Gas Grade Recommendations

Analytical Method/ Detector	Instrument Gases	Page Number	Analytical Range < 100 ppm	Analytical Range > 100 ppm	Type of Analysis Impurity Considerations
Gas Chromatography					
TCD (Thermal Conductivity Detector)	Ar	B•26	AR 5.5TG	AR 5.0UH	**Universal Detector** Atmospheric contaminants can oxidize the detector filament giving rise to negative peaks and reduced sensitivity.
	He	B•53	HE 5.5TG	HE 5.0UH	
	H_2	B•54	HY 6.0RS	HY 5.0UH	
	N_2	B•65	NI 5.5TG	NI 5.0UH	
FID (Flame Ionization Detector)	Air	B•24	AI 0.0UZ	AI 0.0UZ	**Organic Compounds** Hydrocarbons in carrier and fuel gases can give rise to baseline noise and reduced detector sensitivity. Oxygen and water cause column deterioration and affect retention time on critical separations.
	Ar	B•26	AR 5.5TG	AR 5.0UH/ AR 4.8Z	
	He	B•53	HE 5.5TG	HE 5.0UH/ HE 4.6Z	
	H_2	B•54	HY 6.0RS	HY 5.0UH/ HY 4.5Z	
	N_2	B•65	NI 5.5TG	NI 5.0UH/ NI 4.8Z	
	40% H_2 in He	D•218	IG F12UH	IG F11	
	40% H_2 in N_2	D•218	IG F14UH	IG F13	
ECD (Electron Capture Detector)	He	B•53	HE 5.5EC/ HE 5.5TG	HE 5.5TG	**Electronegative Functional Groups** Detector response and column life are reduced by oxygen and water. Hydrocarbons and halocarbons can produce baseline noise, negative peaks, and plumbing contamination.
	N_2	B•65	NI 5.5EC/ NI 5.5TG	NI 5.5TG	
	5% CH_4 in Ar (ECD P-5)	D•218	IG ECD1	IG ECD1	
	10% CH_4 in Ar (ECD P-10)	D•218	IG ECD2	IG ECD2	
FPD (Flame Photometric Detector)	Air	B•24	AI 0.0UZ	AI 0.0Z	**Sulfur or Phosphorous Compounds** Organics can yield baseline noise and carbon dioxide can suppress detector response.
	He	B•53	HE 5.5TG	HE 5.0UH	
	H_2	B•54	HY 6.0RS	HY 5.0UH	
	N_2	B•65	NI 5.5TG	NI 5.0UH	
PID (Photo Ionization Detector)	He	B•53	HE 5.5TG	N/A	**Selective Detector Dependent on UV Source** Organics can yield baseline noise and carbon dioxide can suppress detector response.
	H_2	B•54	HY 6.0RS	N/A	
	N_2	B•65	NI 5.5TG	N/A	
MS (Mass Spectrometer)	Ar	B•26	AR 5.5TG	AR 5.0UH	**Universal Detector** Organics can yield baseline noise and carbon dioxide can suppress detector response.
	He	B•53	HE 5.5TG	HE 5.0UH	
	H_2	B•54	HY 6.0RS	HY 5.0UH	
	N_2	B•65	NI 5.5TG	NI 5.0UH	
DID (Discharge Ionization Detector)	He	B•53	HE 6.0RS	N/A	**Universal Detector** Atmospheric impurities can cause baseline noise signal polarity and reduced detector stability and sensitivity.
	He Purge	B•53	HE 5.0UH	N/A	
USD (Ultrasonic Detector)	Ar	B•26	AR 5.0UH	AR 5.0UH/ IAR 4.8Z	**Universal Detector** Atmospheric impurities can cause baseline noise signal polarity and reduced detector stability and sensitivity.
	He	B•53	HE 5.0UH	HE 5.0UH/ HE 4.6Z	

Praxair's Gas Grade Recommendations

Analytical Method Detector	Instrument Gases	Page Number	Analytical Range < 100 ppm	Analytical Range > 100 ppm	Type of Analysis Impurity Considerations
Optical Spectometry – Absorption					
IR (Infrared)	Air	B•24	AI 0.0UZ	AI 0.0Z	**Polyatomic and Heteroatomic Compounds** Oxygen can oxidize a sample. Moisture interferes with IR spectra. Impurities coinciding with analyte peaks can cause inaccuracies.
	Ar	B•26	AR 5.0UH	AR 5.0UH	
	N_2	B•65	NI 5.0UH	NI 5.0UH	
	LN_2	B•85	Liquid	Liquid	
AA (Atomic Absorption)	Air	B•24	AI 0.0Z	AI 0.0Z	**Elemental Analysis** Impurities can cause the flame to discolor or burn unevenly. Furnace atmospheres require low oxygen and moisture levels to maintain instrument sensitivity.
	Ar	B•26	AR 5.0UH	AR 5.0UH	
	C_2H_2	B•23	AC 2.6AA	AC 2.6AA	
	n-C_4H_{10}	B•31	BU 2.5IS	BU 2.5IS	
	H_2	B•54	HY 4.5Z	HY 4.5Z	
	N_2	B•65	NI 5.0UH	NI 5.0UH	
	N_2O	B•69	NS 2.5AA	NS 2.5AA	

Gas Grade Legend

AA – Atomic Absorption
EC – Electron Capture Detector
IS – Instrument
RS – Research/Chromatographic
TG – Trace Analytical
UH – Ultra High Purity
UZ – Ultra Zero
Z – Zero

Please refer to designated page numbers for available cylinder styles, contents, and other information.

Please refer to the Instrumentation Mixture Summary on page D•218 for additional information regarding mixtures.

Please refer to the Regulator Reference Guide on page E•241 for help in selecting the appropriate cylinder regulator.

Application Note: Helium and Hydrogen Carrier Gases for Gas Chromatography

Helium and hydrogen are the most common carrier gases used for gas chromatography applications. These two gases deliver similar optimum achievable separation efficiencies (theoretical plates). Hydrogen offers advantages versus helium in having a higher and broader range of linear velocities for which near-optimum separation efficiency can be achieved, especially for applications requiring longer columns (higher inlet pressures). The higher linear velocities available to hydrogen enable significant potential reductions in analysis time. Unlike inert helium, hydrogen has the potential to react with some analytes; such reactions are uncommon under normal gas chromatography conditions. Users should note that conversion from one carrier gas to another can involve significant changes to standard operating procedures. In executing a conversion from helium to hydrogen, one must consider not only compatibility of the gas chromatograph but also the associated plumbing and connected components (e.g., filters or mass spectrometer). Hydrogen presents flammability and asphyxiation hazards, and appropriate safety precautions should be taken in accordance with careful risk assessment when working with hydrogen in a lab. Helium is typically supplied via cylinders, while hydrogen can be supplied via cylinders or on-site generators. With decades of experience in supplying gases for analytical instruments, Praxair is prepared to help users identify and move forward their preferred best gas solutions for their particular applications.

Praxair's Gas Grade Recommendations

Analytical Method Detector	Instrument Gases	Page Number	Analytical Range < 100 ppm	Analytical Range > 100 ppm	Type of Analysis Impurity Considerations
Optical Spectrometry – Atomic Emission					
ICP (Inductively Coupled Plasma)	Ar	B•26	AR 4.8IC	AR 4.8IC	**Elemental Analysis** (see application note below)
	LAr	B•82	AR 4.8IC	AR 4.8IC	
	N_2	B•65	NI 5.0UH	NI 5.0UH	
Flame	Air	B•24	AI 0.0Z	AI 0.0Z	**Elemental Analysis**
	C_2H_2	B•23	AC 2.6AA	AC 2.6AA	
	n-C_4H_{10}	B•31	BU 2.5IS	BU 2.5IS	
	H_2	B•54	HY 4.5Z	HY 4.5Z	
	N_2O	B•69	NS 2.5AA	NS 2.5AA	
Arc or Spark	Ar	B•26	AR 5.0UH	AR 4.8	**Elemental Analysis**
	H_2	B•54	HY 5.0UH	HY 4.5Z	
	5% Ar in H_2	D•218	IG NC6	IG NC6	
Optical Spectrometry – Chemiluminescence					
Chemiluminescence	Air	B•24	AI 0.0CE	AI 0.0CE	**Atmospheric Pollutants – NO_x, SO_x, O_3**
	N_2	B•65	NI 5.5CE	NI 5.5CE	
	O_2	B•70	OX 4.3UH	OX 4.3UH	
Optical Spectrometry – Fluorescence					
XRF (X-Ray Flourescence)	10% CH_4 in Ar	D•218	IG P10	IG P10	**Elemental Analysis**
	1.3% n-C_4H_{10} in He	D•218	IG NC4	IG NC4	
	0.95% i-C_4H_{10} in He	D•218	IG NC5	IG NC5	
	LN_2	B•85	NI 4.8LC	NI 4.8LC	
UVF (Ultra-Violet Fluorescence)	Air	B•24	AI 0.0VC	AI 0.0VC	**SO_2 - H_2S - Organic Compounds**
	N_2	B•65	NI 5.5CE	NI 5.5CE	

Application Note: Using Argon with ICP

Inductively coupled plasma (ICP) is a popular means of preparing analytes for atomic emission spectrometry (ICP-AES) and mass spectrometry (ICP-MS). In both methods, the high temperature, ionizing environment of the plasma converts analyte molecules into excited-state atoms and ions. AES methods identify and quantify elements in the analyte on the basis of the electromagnetic radiation emitted by the excited-state species, while MS methods separate and quantify the ions on the basis of their mass-to-charge ratio. Argon is almost always used as the plasma gas for ICP applications. High purity argon is required to sustain a robust plasma, prevent instrument contamination, and avoid interferences with analytes. Praxair offers a variety of argon grades to meet the requirements of most instruments; the AR4.8IC grade is most commonly used. Argon is purified from atmospheric air and may contain trace levels of krypton, which can interfere with ICP-MS analyses for selenium and strontium. Argon flow rates for ICP often exceed 10 liters per minute, making these applications good candidates for cryogenic liquid supply options. Liquid supply via dewars or microbulk can reduce unit costs and disruptions associated with changing cylinders. Cylinders better preserve product and lab space when ICP instrument usage is infrequent. Praxair can help ICP users choose the right grades and supply options for their needs.

Praxair's Gas Grade Recommendations

Analytical Method Detector	Instrument Gases	Page Number	Analytical Range < 100 ppm	Analytical Range > 100 ppm	"Type of Analysis Impurity Considerations"
Others					
NMR (Nuclear Magnetic Resonance)	LHe	B•84	Liquid	Liquid	**Analysis of Molecular Structure**
	LN_2	B•85	Liquid	Liquid	
MS (Mass Spectrometry)	Air	B•24	AI 0.0UZ	AI 0.0UZ	**All Compounds via Various Ionization Sources**
	Ar	B•26	AR 5.5TG/ AR 5.0UH	AR 5.0UH/ AR 4.8IC	
	LAr	B•82	AR 5.0	AR 5.0/ AR 4.8IC	
	He	B•53	HE 5.5TG	HE 5.0UH	
	H_2	B•54	HY 6.0RS	HY 5.0UH	
	N_2	B•65	NI 5.5TG/ NI 5.0UH	NI 5.0UH	
	LN_2	B•85	NI 5.0	NI 5.0/ NI 4.8	
	NH_3 in He	C•99	Certified Standard	Certified Standard	
Nuclear Counter	5% CH_4 in Ar	D•218	IG P5	IG P5	**Radioactivity**
	10% CH_4 in Ar	D•218	IG P10	IG P10	
	1.3% n-C_4H_{10} in He	D•218	IG NC4	IG NC4	
	0.95% i-C_4H_{10} in He	D•218	IG NC5	IG NC5	
Hydrometer	Air	B•24	AI 0.0UZ	AI 0.0Z	**Moisture in All Gases**
	N_2	B•65	NI 6.0RS	NI 5.0UH	
Paramagnetic Analyzer	N_2	B•65	N/A	NI 5.0UH	**Oxygen in All Gases**
	O_2 in N_2	C•127	Certified Standard	Certified Standard	
Combustion Analyzer	Ar	B•26	AR 5.0UH	AR 5.0UH	**Elemental Analysis – Carbon, Nitrogen, Sulfur**
	He	B•53	HE 5.0UH	HE 5.0UH	
	N_2	B•65	NI 5.0UH	NI 5.0UH	
	O_2	B•70	OX 5.0RS	OX 5.0RS	

Gas Grade Legend

CE – Continuous Emissions Monitoring
ICP – Inductively Coupled Plasma
RS – Research/Chromatographic
TG – Trace Analytical
UH – Ultra High Purity
UZ – Ultra Zero
VC – Volatile Organic Compound Free
Z – Zero

Please refer to designated page numbers for available cylinder styles, contents, and other information.

Please refer to the Instrumentation Mixture Summary on page D•218 for additional information regarding mixtures.

Please refer to the Regulator Reference Guide on page E•241 for help in selecting the appropriate cylinder regulator.

Instrument Mixture Summary

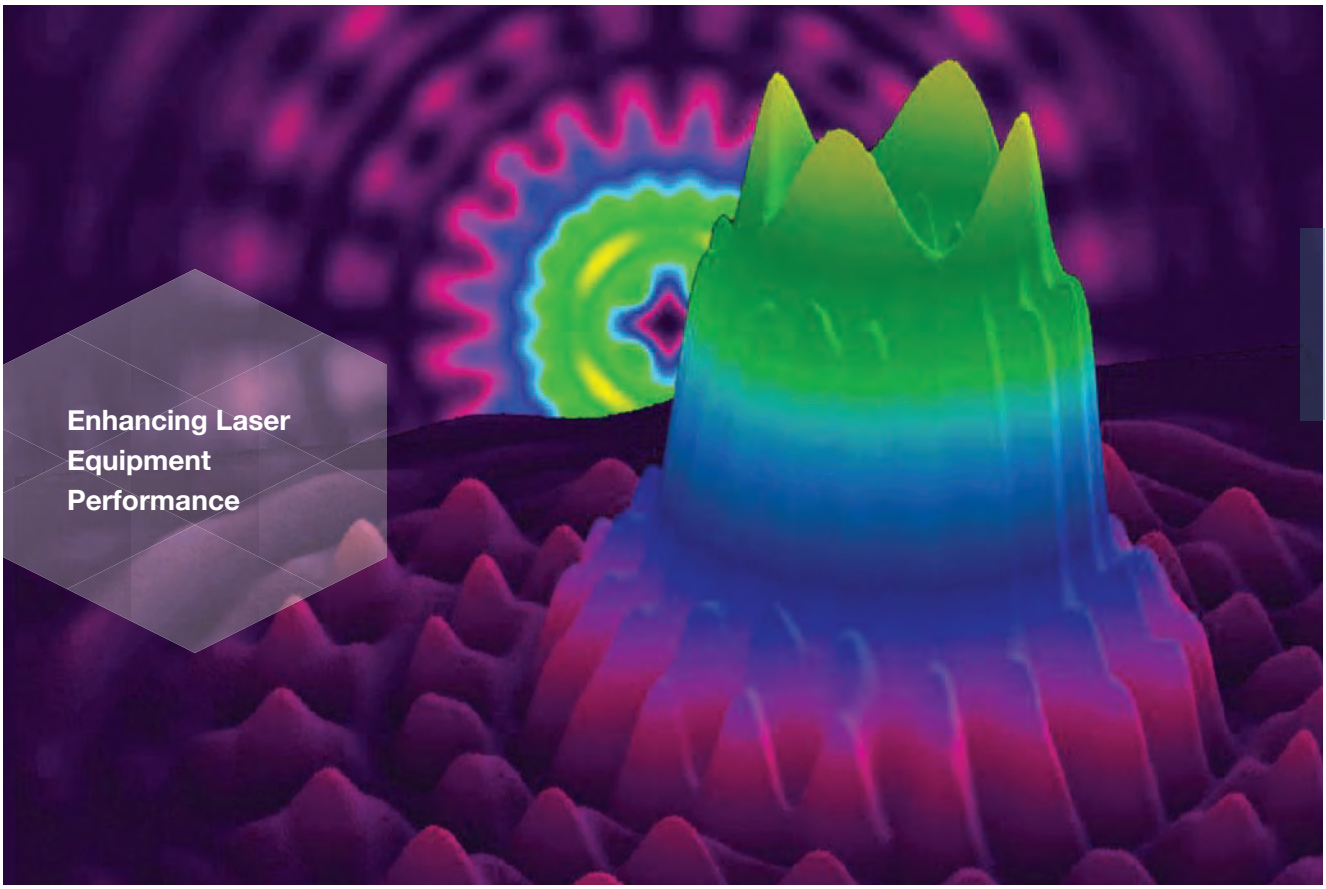
Part Number	Product Description	Mixture Application	Cylinder Style	CGA Connection
IG F11-K	40% H_2 in He (FID Fuel) (THC < 0.5 ppm)	Fuel Gas for GC-FID	K	350
IG F12UH-K	40% H_2 in He UHP (FID Fuel) (THC < 0.1 ppm)	Fuel Gas for GC-FID	K	350
IG F13-K	40% H_2 in N_2 (FID Fuel) (THC < 0.5 ppm)	Fuel Gas for GC-FID	K	350
IG F14UH-K	40% H_2 in N_2 UHP (FID Fuel) (THC < 0.1 ppm)	Fuel Gas for GC-FID	K	350
IG ECD1-K	5% CH_4 in Ar (ECD P-5)	Make-Up Gas for GC-ECD	K	350
IG ECD2-K	10% CH_4 in Ar (ECD P-10)	Make-Up Gas for GC-ECD	K	350
IG P5-K	5% CH_4 in Ar (P-5)	Proportional Counters	K	350
IG P10-K	10% CH_4 in Ar (P-10)	Proportional Counters and X-Ray Fluorescence	K	350
IG NC4-K	1.3% n-C_4H_{10} in He	Geiger-Muller Counters and X-Ray Fluorescence	K	350
IG NC5-K	0.95% i-C_4H_{10} in He	Geiger-Muller Counters and X-Ray Fluorescence	K	350
IG NC6-K	5% Ar in H_2	Spark Emission	K	350

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

Please refer to the Regulator Reference Guide on page E•241 for help in selecting the appropriate cylinder regulator.

Laser Gases and Support

Overview



Praxair's *LaserStar*™ gases are the right choice for your laser system. Our knowledgeable team can help you design a complete laser gas solution Including high quality resonator and assist gases, supply modes and delivery systems that are best for your laser operation.

LaserStar™ Resonator Gases

Lasers must be protected from moisture, hydrocarbons, and other contaminants that can be introduced into the resonator by the gas supply system. These impurities may reduce laser productivity and power, create unstable operating characteristics, may cause damage to expensive optics, and may contribute to costly down time. Using Praxair's *LaserStar* Resonator gases can add years to the CO_2 laser resonator life and reduce maintenance expense.

LaserStar 5.0 resonator gas is available as a 99.999% pure gas or pre-blended mixtures of helium, nitrogen, carbon dioxide and when required, hydrogen and is five times cleaner than the industry standard laser resonator gas.

Praxair's patented *LaserStar* 5.5 resonator gas is available as 99.9995% pure or pre-blended mixtures and is ten times cleaner than the industry standard resonator gas. It would take 20 cylinders of *LaserStar* 5.5 resonator gas to deliver the same level of contaminants in just two of the industry standard resonator gas.

Laser Assist Gases and Gas Supply Modes

Praxair provides high quality laser assist gases to support your laser operation. With gas supply modes ranging from single cylinders and clusters, to microbulk and bulk supplies, we can provide a custom system appropriate for your production needs.

Gas Distribution Equipment and Systems

A properly designed gas supply system is key to protecting the purity and integrity of your laser gases and to protect your laser resonator from contaminants. A gas delivery system including Praxair's *LaserStar* gas handing equipment can help ensure the delivery of your high quality gases from your supply to your resonator.

Laser Inspection

Praxair's Laser inspection provides a detailed report of your laser system's health and a list of what is operating outside of specifications to help you identify and plan for maintenance needs.

Technical Support and Customer Service

Praxair's expert team can help you plan your laser purchase, provide the right gas supply system for your facility and help you keep your laser operating productively with support and excellent customer service.

Laser Gases and Support

Laser Gas Supply Systems Overview

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Praxair® LaserStar™ Gases and Blends

For optimum laser performance Praxair's *LaserStar*™ gases are produced to meet the stringent requirements of the laser processing industry. Available as pure gases or pre-blended mixtures of helium, nitrogen, carbon dioxide, and occasionally, carbon monoxide, Praxair's *LaserStar*™ gases are used to generate the laser beam in a wide variety of CO_2 lasers.

Carbon dioxide lasers must be protected from the problems created by moisture, hydrocarbons, and other contaminants which can be introduced through the gas supply system. These impurities may reduce laser power, create unstable operating characteristics, damage expensive optics, and cause costly downtime. With a properly designed delivery system, the use of *LaserStar*™ gases can help you assure peak performance for longer periods of time between maintenance cycles and reduce maintenance costs.

Supply Modes

From laser resonator gases to assist gases, welding and cutting operations can be optimized when proper care is exercised in the design and selection of the gas supply system. Praxair offers a variety of supply modes that will help improve economy and productivity.

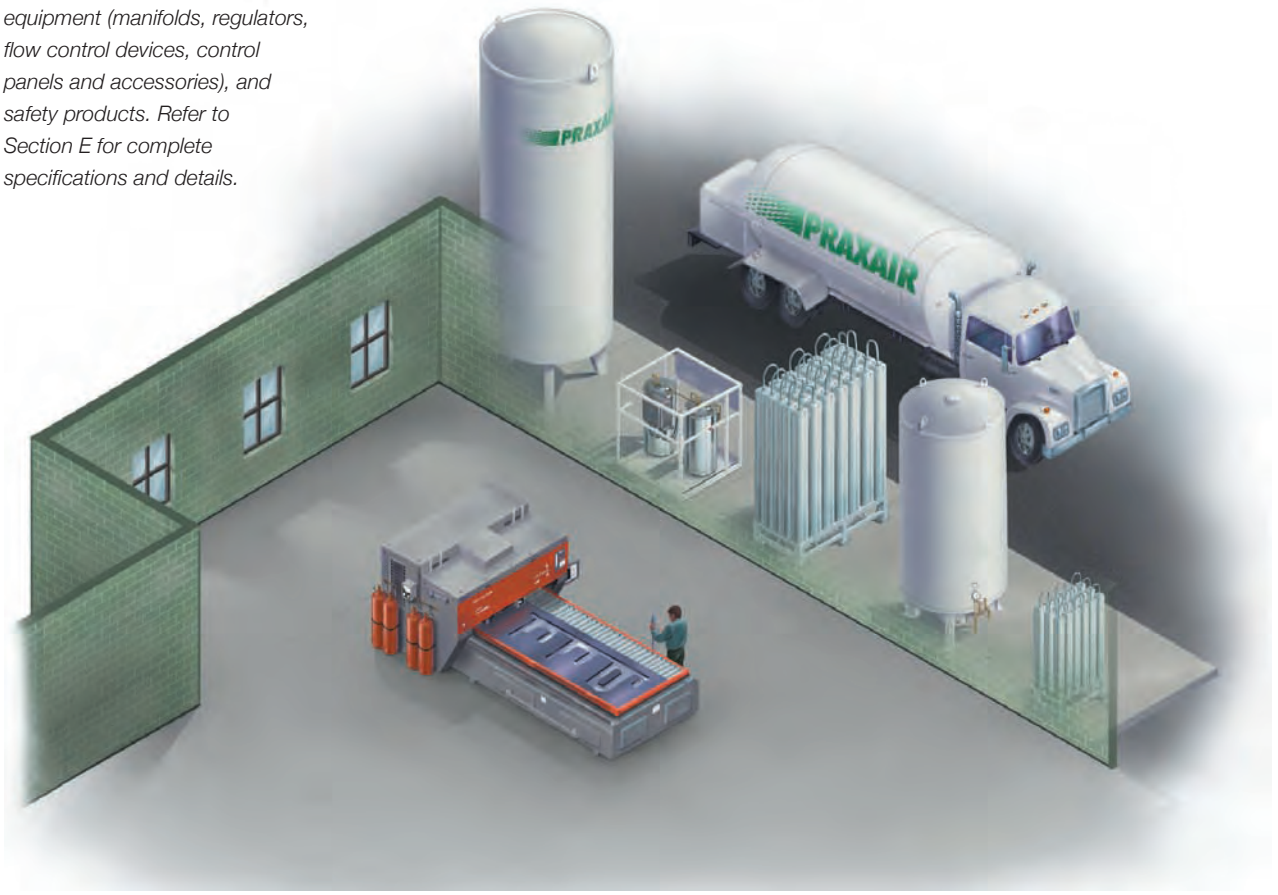
- High Pressure Cylinders
- Micro Bulk Tanks
- Bulk Tanks with or without a Cryogenic Booster.

Gas Regulation and Distribution System Design

To further enhance laser equipment performance, high quality regulation and distribution equipment systems must be employed. These specially designed systems offer a number of advantages:

- Help to maintain gas purity and gas mixture integrity (to the use point)
- Contribute to precise pressure and flow control
- Provide uninterrupted gas supply
- Improve operational safety and ease of use
- Decrease the frequency for periodic laser maintenance.

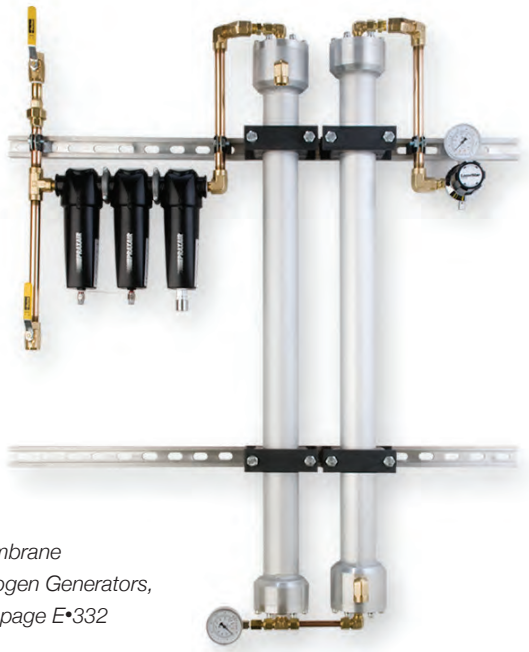
Praxair offers a complete line of gas handling and delivery equipment (manifolds, regulators, flow control devices, control panels and accessories), and safety products. Refer to Section E for complete specifications and details.



Laser Gases and Support Equipment

Praxair offers a complete line of gas handling and delivery equipment (manifolds, regulators, flow control devices, control panels and accessories), and safety products. Refer to Section E for complete specifications and details.

LaserStar™ Nitrogen Assist Gas Regulator. Contact your Praxair representative for more details.



Membrane Nitrogen Generators, see page E•332

PRX M5 N_2 Generator with air compressor and air tank, see page E•328

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Improve Laser Efficiency and Performance with Praxair's Laser Inspection

It's easy to see and determine if your mechanical metal cutting tools are sharp, however, your laser is more challenging since the cutting beam is invisible. But how do you know if your laser is as effective as it could be? Praxair's Laser Inspection can help.

With Praxair's Laser Inspection, several output aspects of your laser will be examined, such as beam power at the work piece versus the power produced in the resonator and beam shape.

We also review your laser gas delivery system, which has proven to reduce gas expense and extend laser component service life. This combination provides a recipe of continuous performance, while minimizing laser downtime.

The inspection is non-invasive and only takes 20-60 minutes. Once the testing is complete, you'll be able to view a computer-generated report that will give you an instantaneous diagnosis of the beam and a clear explanation of what part of the beam is out of spec.

Old Beam Checking Methods

Tape Shot
- 2D method lacks spatial beam profile
- Fails to define energy distribution
- Ignores beam fluctuations over time

Acrylic Mode Burns
- 3D method lacks spatial beam profile
- Fails to define energy distribution
- Ignores beam fluctuations over time

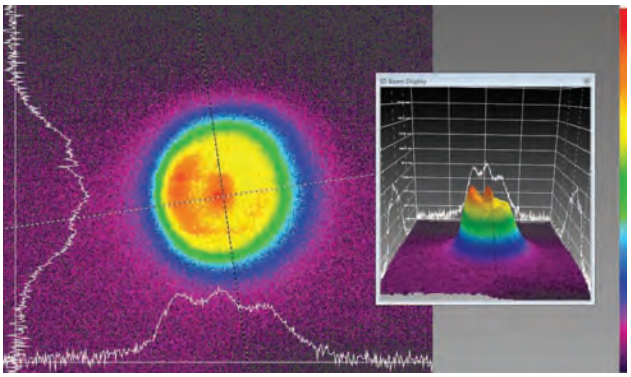
Output Wattage
- Resonator power reported only in the power source

Praxair's Laser Inspection

Praxair's Laser Inspection
- 3D beam scan with spatial beam profile
- Defines 3D color energy distribution
- Reports beam fluctuations over time
- Reports power at the work piece
- Accurate readings of diameter and ellipticity
- Provides ellipticity ratios and measurements

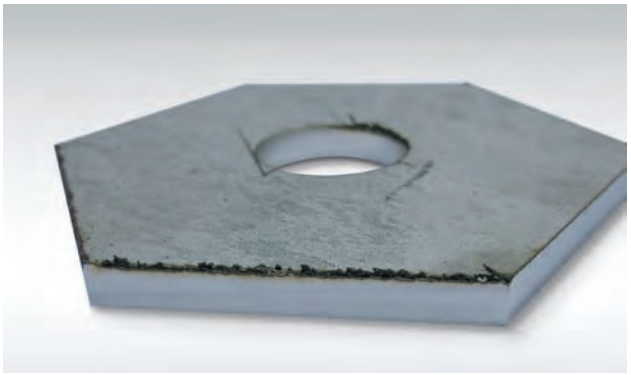
Real-time imaging example

Beam Analysis



Rear mirror is misaligned

Resulting Cut



Dross and reduced cutting speed

Laser Gases and Support

Services

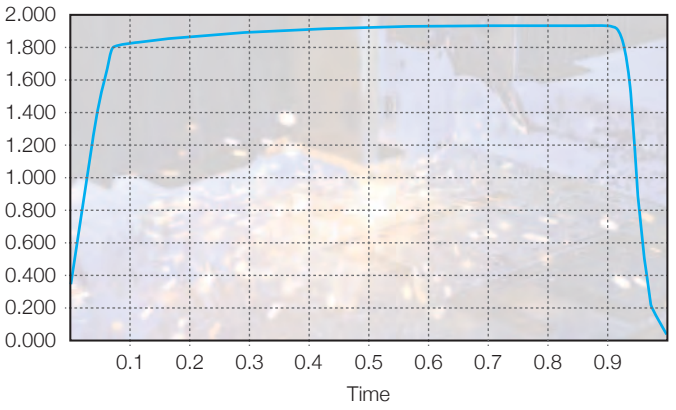
Analyzing the balance of shape and power

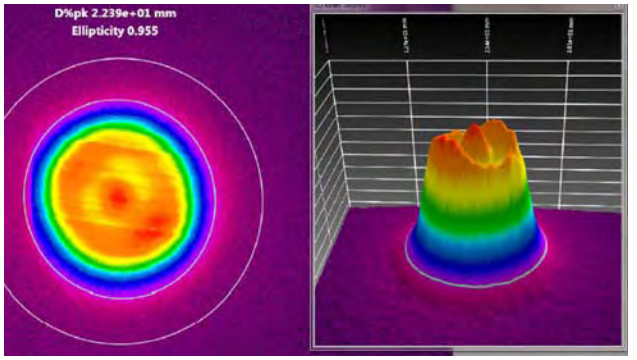
Power – The Praxair Laser Inspection looks at the power delivered to the work piece and compares it to the power developed in the resonator. If your output coupler, mirrors and focusing lens are performing normally, the wattage developed in the resonator should be wattage delivered to the work piece.

Shape: Beam shape is defined in a three dimensional, computer-generated graphic, and displays the beam ellipticity, height, average diameter and intensity. A compromised shape will cause the laser cutting speed to diminish, while increasing dross on your parts, labor, power and gas expenses.

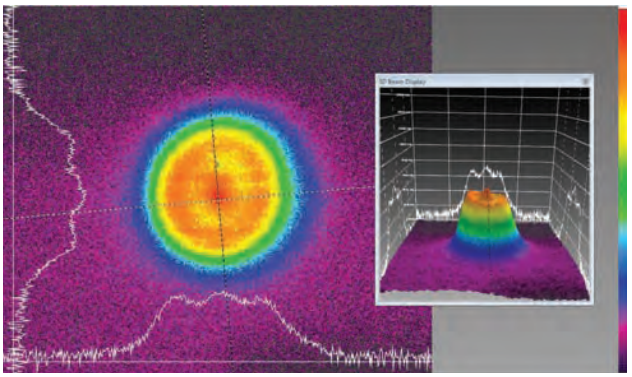
Praxair will provide you with an analysis of your beam profile during testing and a written report following the review. This will assist your laser service provider in determining where corrections and adjustments need to be made. In turn, this may allow you to save money on repairs and may lead to higher productivity.

Get the most work out of your laser beam between planned maintenance cycles. Call your Praxair representative for more information at 800.225.8247.



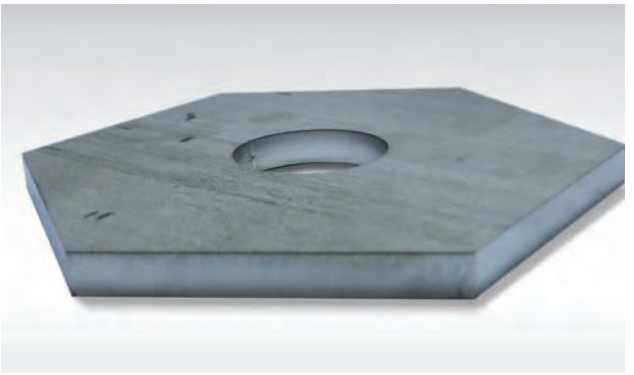


Beam Analysis



Mirror is now realigned

Resulting Cut



Clean cut, cutting speed increased 20%

Laser Gases and Support

Laser Component and Pre-Mixed Gases

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LaserStar™ gases are available from more than 400 stores in the U.S. and Canada. The minimum gas specifications shown help ensure optimal laser performance. A certificate of analysis (COA) can be requested at the time your order is placed.

Praxair's Standard Grade Components and Pre-Mixed Gases

- Offered in steel cylinders
- Produced in all Praxair Specialty Gases laboratories and production centers and available from more than 400 locations in the U.S. and Canada
- Mixtures are prepared using component gases with minimum specifications as listed in the table.

Standard Grade Components – Minimum Purity Standards – Specifications

Component Gas	Purity	Trace Moisture	Oxygen	Total Hydrocarbon
Helium	99.997%	< 3 ppm	< 3 ppm	< 1 ppm
Nitrogen	99.999%	< 1 ppm	< 3 ppm	< 0.5 ppm
Carbon Dioxide	99.995%	< 5 ppm	< 5 ppm	< 1 ppm

Product	Cylinder Style	Contents	Part Number
Helium	T	291 ft^3	HE 4.7LS-T
Nitrogen	T	304 ft^3	NI 5.0LS-T
Carbon Dioxide	K	50 pounds	CD 4.5LS-K

Pre-Mixed CO_2 Laser Resonator Gases

CO_2	N_2	HE	CO	H_2	Cylinder Style	Content	Pressure psig	Part Number
1.7%	23.4%	74.9%	–	–	T	278 ft^3	2,640	LS HECDNI6-T
3.14%	31.4%	65.46%	–	–	T	291 ft^3	2,640	LS HECDNI26-T
3.4%	15.6%	81.0%	–	–	T	281 ft^3	2,640	LS HECDNI14-T
4.5%	13.5%	82.0%	–	–	T	281 ft^3	2,640	LS HECDNI1-T
5.0%	55.0%	40.0%	–	–	T	291 ft^3	2,640	LS NICDHE2-T
5.0%	35.0%	60.0%	–	–	T	291 ft^3	2,640	LS HECD5NI3-T
5.0%	25.0%	70.0%	–	–	T	291 ft^3	2,640	LS HECD5NI4-T
5.1%	29.1%	65.8%	–	–	AT	291 ft^3	2,640	LS HECD5.1N1Z-T
5.378%	27.0%	67.6%	–	218 ppm	T	291 ft^3	2,640	LS HEX43-T
5.40%	27.0%	67.6%	–	–	T	291 ft^3	2,640	LS HECDNI7-T
8.0%	60.0%	28.0%	4.0%	–	T	272 ft^3	2,400	LS NIX41-T

Laser Gases and Support

Laser Component and Pre-Mixed Gases

***Praxair's LaserStar™* 5.0 Resonator Gas – Less than 10 ppm possible contamination**

- Offered in steel cylinders
- Mixtures are prepared using component gases with minimum specifications as listed
- *LaserStar*™ 5.0 is five times cleaner than minimum industry standards.

***Praxair's LaserStar™* 5.0 Resonator Gas – Specifications**

Component Gas	Purity	Trace Oxygen	Moisture	Total Hydrocarbon
Helium	99.999%	< 1 ppm	< 2 ppm	< 0.5 ppm
Nitrogen	99.999%	< 1 ppm	< 3 ppm	< 0.5 ppm
Carbon Dioxide	99.999%	< 5 ppm	< 3 ppm	< 1 ppm

Product	Cylinder Style	Contents	Part Number
Helium	T*	291 ft^3	HE 5.0LS-T
Nitrogen	T*	304 ft^3	NI 5.0LS-T
Carbon Dioxide	T*	60 lbs	CD 5.0LS-T

* Steel cylinder

***Praxair's LaserStar™* 5.0 Pre-Mixed CO_2 Laser Resonator Gases**

CO_2	N_2	HE	CO	H_2	Cylinder Style	Content	Pressure psig	Part Number
1.7%	23.4%	74.9%	–	–	T	278 ft^3	2,640	LS HECDNICB6-T
3.14%	31.4%	65.46%	–	–	T	291 ft^3	2,640	LS HECDNICB26-T
3.4%	15.6%	81.0%	–	–	T	281 ft^3	2,640	LS HECDNICB14-T
4.5%	13.5%	82.0%	–	–	T	281 ft^3	2,640	LS HECDNICB1-T
5.0%	55.0%	40.0%	–	–	T	291 ft^3	2,640	LS NICDHECB2-T
5.0%	35.0%	60.0%	–	–	T	291 ft^3	2,640	LS HECD5NICB3-T
5.0%	25.0%	70.0%	–	–	T	291 ft^3	2,640	LS HECD5NICB4-T
5.1%	29.1%	65.8%	–	–	AT	291 ft^3	2,640	LS HECD5.1N1CBZ-T
5.38%	27.0%	67.6%	–	216 ppm	T	291 ft^3	2,640	LS HEX4CB3-T
5.4%	27.0%	67.6%	–	–	T	291 ft^3	2,640	LS HECDNICB7-T
8.0%	60.0%	28.0%	4.0%	–	AT*	272 ft^3	2,400	LS NIX4CB1-AT

* Available only in aluminum cylinder.

Laser Gases and Support

Laser Component and Pre-Mixed Gases

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***Praxair's LaserStar™* 5.5 Resonator Gas – Less than 5 ppm possible contamination**

- Minimum purity 99.9995%
- Packaged in aluminum cylinders
- Concentration of each minor component within +/- 2% accuracy
- Pure gas and mixtures ten times cleaner than minimum industry standard.

***Praxair's LaserStar™* 5.5 Resonator Gas – Specifications**

Component Gas	Purity	Trace Oxygen	Moisture	Total Hydrocarbon	Total Halocarbon
Helium	99.9995%	< 1 ppm	< 1 ppm	< 0.1 ppm	< 50 ppt
Nitrogen	99.9995%	< 1 ppm	< 2 ppm	< 0.1 ppm	< 50 ppt
Carbon Dioxide	99.9995%	< 2 ppm	< 0.5 ppm	< 10 ppb	< 100 ppt

Product	Cylinder Style	Contents	Part Number
Helium	AT*	239 ft^3	HE 5.5LS-AT
Nitrogen	AT*	250 ft^3	NI 5.5LS-AT
Carbon Dioxide	AT*	70 pounds	CD 5.5LS-AT

* Aluminum cylinder

***Praxair's LaserStar™* 5.5 Pre- Mixed CO_2 Laser Resonator Gases**

CO_2	N_2	HE	CO	H_2	Cylinder Style	Content	Pressure psig	Part Number
1.7%	23.4%	74.9%	–	–	AT	232 ft^3	2,200	LS HECDNIPB6-AT
3.14%	31.4%	65.46%	–	–	AT	219 ft^3	2,200	LS HECDNIPB26-AT
3.4%	15.6%	81.0%	–	–	AT	232 ft^3	2,200	LS HECDNIPB14-AT
4.5%	13.5%	82.0%	–	–	AT	232 ft^3	2,200	LS HECDNIPB1-AT
5.0%	55.0%	40.0%	–	–	AT	239 ft^3	2,200	LS NICDHEPB2-AT
5.0%	35.0%	60.0%	–	–	AT	239 ft^3	2,200	LS HECD5NIPB3-AT
5.0%	25.0%	70.0%	–	–	AT	219 ft^3	2,200	LS HECD5NIPB4-AT
5.1%	29.1%	65.8%	–	–	AT	219 ft^3	2,200	LS HECD5.1N1PBZ-AT
5.38%	27.0%	67.6%	–	216 ppm	AT	219 ft^3	2,200	LS HEX4PB3-AT
5.4%	27.0%	67.6%	–	–	AT	219 ft^3	2,200	LS HECDNIPB7-AT
8.0%	60.0%	28.0%	4.0%	–	AT	247 ft^3	2,200	LS NIX4PB1-AT
99.6%	0%	0%	–	4000 ppm	AT	71 ft^3	600	LS CDHY.4ZPB-AT

LaserStar™ 5.5 Gas mixtures are protected by U.S. Patents, US6985507 B2 and US7058108.

Other proprietary component mixtures are available, including a six-part Rofin mixture in aluminum cylinders, part number LSHECD6CX1CA42. The Rofin LaserStar mixture is produced exclusively at Praxair's Paris, Ontario, Canada cylinder filling plant and distributed by Praxair's North Royalton, OH facility.

Life Sciences and Healthcare

Overview

Advancements in the life sciences and healthcare continue to deliver dramatic improvements to quality of life. Praxair provides the critical gases and cryogens that help sustain daily operations in these fields. Praxair also offers gas handling, distribution, and storage equipment to help personnel work safely and productively. From the research lab to the manufacturing plant to the point of care, life science and healthcare customers count on Praxair to supply the highest quality products that meet all technical and regulatory requirements. By providing a comprehensive and consultative one-stop shop for all gas-related needs, Praxair helps the life science and healthcare industries stay focused on making the world a healthier place.

Comprehensive Product Range
Supplying each application with the proper gas (grade, compliance, certification, scale).

Critical Product Manufacturer
Ensuring quality and supply continuity for FDA-regulated medical gases.

Superior Reliability
Delivering products when they are needed.

Equipment and Systems Excellence
Connecting customers with everything needed to use, handle, and store gases efficiently and safely.

Productivity and Innovation Partner
Working with customers to identify and implement productivity and cost improvements.

Ease of Doing Business
Providing convenient e-commerce options and strong customer support.

Safety Focus
Making safety the top priority for every activity.

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Praxair's Medipure™ Medical Gases

Praxair has been serving the life science and healthcare fields for over 50 years. Praxair provides cylinder filing and quality assurance facilities for the preparation of high purity gases and high accuracy mixtures. All products classified by the United States Food and Drug Administration (FDA) and Health Canada's Health Products and Food Branch (HPFB) as drugs or devices are produced in accordance with current Good Manufacturing Practices (cGMPs). Praxair facilities are assessed internally. Strict handling, record-keeping, testing, and training help ensure that the Medipure brand meets your purity, consistency, and regulatory compliance requirements.

Equipment and Systems Excellence

Praxair manufactures and supplies gas handling, storage, and safety solutions:

- Regulators
- Flow meters
- Gas distribution systems
- Gas purification accessories
- Gas generators and back-up systems
- Freezers and cryogenic systems
- Valves, fittings, and CGA connections
- Gas cabinets
- Gas detection and safety equipment

....and much more

Praxair specifies and helps you assemble all gas distribution systems in-house using only high quality components. For laboratories pursuing renovation or expansion, Praxair can design and implement a turn-key build-out.

Protect the purity of your gases and the quality of your lab's results with the right product for the right application.

Multi-Gas Point-of-Use-Panel,
see page E•303

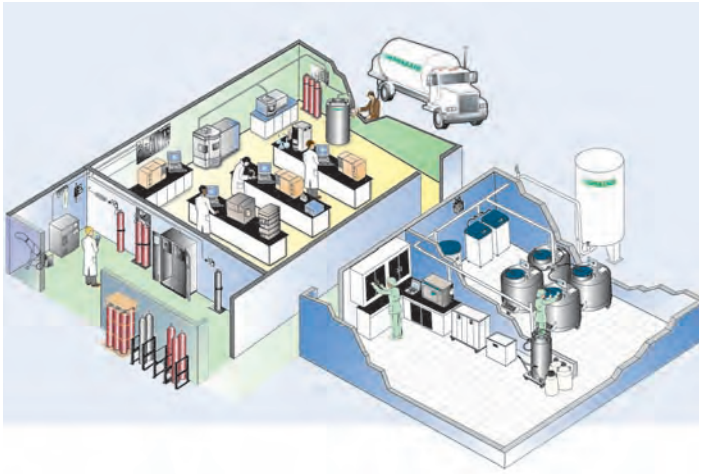
4092 Regulator,
see page E•266

See Section E for additional information on Praxair's full line of *ProSpec*™ gas handling solutions.

Life Sciences and Healthcare

Laboratory Gases and Services

Life science and healthcare analytical and research laboratories depend on the purity and integrity of Praxair products to help them conduct the most accurate experiments possible. Praxair supplies laboratories with a full line of high-purity analytical instrumentation gases, reagent gases, and gas mixtures. Praxair also provides all the equipment necessary to preserve the purity of those gases and employ them productively and safely in the laboratory.



See pages D·214 - D·218 for additional information on Praxair's analytical instrumentation gases.

Laboratory Assessment Program

Praxair applies its extensive experience with specialty gases and equipment to help laboratory managers and scientists review their gas needs and select the proper gas products and delivery systems.

Praxair's Laboratory Assessment Program examines all aspects of gas use, handling, and storage to help laboratories:

- Improve productivity
- Optimize supply modes
- Protect instrumentation and equipment
- Better utilize bench and floor space
- Implement appropriate safety measures
- Streamline transaction processing
- Ensure appropriate product grades and certifications
- Improve asset management
- Reduce costs and mitigate risk

Application Spotlight: Nitrogen for LC-MS

Liquid chromatography-mass spectrometry (LC-MS) is a powerful analytical technique that combines the broadly applicable separation capabilities of LC with the outstanding identification and quantification capabilities of MS. LC-MS has become a standard technique in the life sciences and healthcare for its particular capability to handle non-volatile and thermally labile species (e.g, proteins). Nitrogen gas plays a key role in coupling the LC and MS methods by assisting nebulization and drying of the liquid fractions eluted from LC so they can be ionized for MS analysis. The high flow of nitrogen gas required for this application typically warrants a cryogenic liquid supply source. Most commonly, LC-MS users employ liquid dewars or microbulk systems. Membrane systems producing nitrogen on-site from a compressed air source have become another popular option. Praxair offers a comprehensive suite of nitrogen supply methods and works with LC-MS users to select the optimum supply mode depending on their situation and needs. Praxair analyzes various factors, including type and number of instruments, facility location and layout, and instrument usage levels along with user concerns about productivity, cost, and reliability.

Life Sciences and Healthcare

Cryopreservation

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Biological materials often require cryopreservation for viable long-term storage. Praxair offers a world-class portfolio of cryogenic gases, equipment, and services to enable these applications.

As a fully integrated supplier, Praxair provides cryogenic liquid nitrogen in dewar, microbulk, and bulk scales and can implement a complete turn-key liquid nitrogen distribution system to fit any needs. The table below lists the liquid nitrogen products most commonly selected for cryopreservation applications. NF grade liquid nitrogen products are also available as described on page D•233.

Praxair offers a comprehensive suite of cryogenic equipment, including high efficiency vapor-phase freezers; standard liquid-phase freezers; vapor shippers; and all the related racking systems and sample handling accessories.

Praxair's cryorepository service goes well beyond freezer selection and sales. Our factory-trained technicians are also available for freezer installation, start-up, proactive maintenance, emergency service, and repair. Proactive maintenance helps ensure your freezer is operating correctly and providing the right environment for your samples.

Customers also rely on Praxair for easy, cost-effective back-up systems for mechanical, compressor-based ultra-low temperature freezers. In the event of a freezer malfunction, emergency cooling can be provided by a cylinder of carbon dioxide or tank of liquid nitrogen. These cryogenic back-up options provide a transition time for freezer repair or sample relocation.

At Praxair, we have years of experience in designing, installing, and servicing cryorepositories – from a single freezer to multiple freezer banks. Working closely with end users, we'll configure a system that meets your needs today and tomorrow.

See pages E•340 - E•373 for additional information on Praxair's complete line of cryogenic equipment.

Praxair's StarWatch Cryogenic Monitoring System accurately measures liquid level and pressure in portable liquid containers (dewars). See page B•87 for more details.

Liquid Nitrogen for Cryogenic Storage

Product/Grade	Purity	Part Number	Typical Cylinders	O_2	H_2O	THC
UHP, 5.0	99.999%	NI 5.0LC	160, 180, 230	1	3	0.5
High Purity, 4.8	99.998%	NI 4.8LC	160, 180, 230	5	3	–

Concentrations given are maximum ppm by volume unless otherwise specified.

Cylinders

Cylinder Type	Style	Height in (cm)	Connection CGA	Typical Pressure Relief Setting psig	Volume ft^3 (m^3)	Gross Weight lb (kg)
160	Portable Liquid Unit	60 x 20 (152.4 x 50.8)	580 (Gas), 295 (Liquid)	22	3,519 (98)	505 (229)
180	Portable Liquid Unit	64 x 20 (162.6 x 50.8)	580 (Gas), 295 (Liquid)	22	4,099 (113)	557 (253)
230	Portable Liquid Unit	53 x 26 (134.6 x 66.0)	580 (Gas), 295 (Liquid)	22	5,023 (140)	664 (301)

Ask your Praxair sales representative about Microbulk supply systems and piping design services.

Life Sciences and Healthcare

Incubation

Praxair provides a variety of gases used to promote and regulate growth of cells and tissues. The two most common pure carbon dioxide grades selected for such applications are U.S. Pharmacopoeia (USP)-grade CO_2 and non-USP-grade CO_2 3.0 (99.9%). The table below lists standard aerobic and anaerobic incubation mixtures incorporaing carbon dioxide; custom mixtures are also available. All incubation mixtures are manufactured following USP and National Formulary (NF) specifications and current Good Manufacturing Practices (cGMPs).

Biological Incubation

Part Number*	Description**	Typical Cylinder Style	Contents (ft^3/m^3)	CGA	Regulator Recommendations
Growing Cells and Cultures					
CD M	Carbon Dioxide USP	Refer to page D•235 for complete specifications and details			
CD 3.0	Carbon Dioxide 99.9%	Refer to page D•235 for complete specifications and details			
Aerobic Incubation Mixtures					
BG NICD5C-K	5% Carbon Dioxide/Oxygen	K	228/6.32	500	3000 Series
BG NICDOXC23-K	5% Carbon Dioxide/5% Oxygen/Nitrogen	K	228/6.32	500	(page E•250)
BG NICDOXC18-K	5% Carbon Dioxide/10% Oxygen/Nitrogen	K	228/6.32	500	
BG NICDOX1C1-K	2.5% Carbon Dioxide/21% Oxygen/Nitrogen	K	228/6.32	500	
BG NICDOXC9-K	5% Carbon Dioxide/21% Oxygen/Nitrogen	K	228/6.32	500	
BG NICD1022C-K	10% Carbon Dioxide/21% Oxygen/Nitrogen	K	228/6.32	500	
BG NICD15O1C-K	15% Carbon Dioxide/21% Oxygen/Nitrogen	K	228/6.32	500	
Anaerobic Incubation Mixtures					
BI NICD5C-K	5% Carbon Dioxide/Nitrogen	K	228/6.32	500	3000 Series
BI NICD5HY1-K	5% Carbon Dioxide/5% Hydrogen/Nitrogen	K	228/6.32	350	(page E•250)
BI NICD5H1-K	5% Carbon Dioxide/10% Hydrogen/Nitrogen	K	228/6.32	350	
BI NICD10H1-K	10% Carbon Dioxide/ 10% Hydrogen/Nitrogen	K	228/6.32	350	
BI CDHY3C-K	3% Hydrogen/Carbon Dioxide	K	228/6.32	350	

* Add the desired cylinder style to the end of the listed part numbers to create the complete part number (e.g., BI OXCD5-K).

** In the U.S., biological incubation mixtures are certified to USP standards. In Canada, biological incubation mixtures are supplied as standard specialty gas mixtures with non-medical valves.

Certificate of analysis available upon request.
Please inquire about additional mixtures not listed.

Medical Air USP

Chemical formula: A natural or synthetic mixture of gases consisting largely of nitrogen and oxygen. Contains not less than 19.5% and not more than 23.5% by volume oxygen.

Example Applications: Respiratory therapy; humidity treatments using nebulizers; pharmaceutical processing.

See Pure Gas Section For Transport Information (page B•24)



Color Code			
Shoulder	Yellow	Black & White	Black & White
Body		Yellow DIN: 02014483	Purple

Medical Air USP

Part Number	Specification	Cylinder Style/ CGA Connection	Content (ft^3/m^3)	Pressure (psig/bar)
AI M-T	O_2: 19.5 - 23.5% Balance N_2 (NF) Water: < 50 ppm Odor: None	T/346	310/8.60	2,640/183
AI M-K		K/346	232/6.43	2,200/154
AI M-E		E/950	23/0.64	2,000/154
AI M-AE		AE/950	22/0.61	2,000/139
AI M-D		D/950	14/0.39	2,000/154
AI M-AEAIRTOTE		AE/Regulator included	22/0.61	2,000/139

Nitrous Oxide USP

Chemical Formula: N_2O

Example Applications: Analgesic often used in combination with other agents for producing anesthesia; cryosurgery.

See Pure Gas Section For Transport Information (page B•69)



Color Code			
Shoulder	Blue	Blue	Blue
Body		Blue DIN: 02014467	Blue

Nitrous Oxide USP

Part Number	Specification	Cylinder Style/ CGA Connection	Content (lb/kg)	Pressure (psig/bar)
NS M-64	N_2O: ≥ 99.0%	K/326	64/29.0	745/51
NS M-50		K/326	50/22.7	745/51
NS M-E		ME/910	6.6/2.97	745/51
NS M-D		MD/910	3.8/1.73	745/51

Helium USP

Chemical Formula: He

Example Applications: Reduce density of breathing mixtures and facilitate breathing under certain physical and physiological conditions.

See Pure Gas Section For Transport Information (page B•53)



Color Code			
Shoulder	Brown	Dark Brown	Brown
Body	Brown	Orange DIN: 02014475	

Helium USP

Part Number	Specification	Cylinder Style/ CGA Connection	Content (ft^3/m^3)	Pressure (psig/bar)
HE M-K	He: ≥ 99.0% Air: < 1.0% Odor: None	K/580	218/6.05	2,200/154
HE M-E		ME/930	22/0.62	2,000/154
HE M-D		MD/930	13/0.37	2,000/154

See page B•84 for non-USP-grade cryogenic liquid helium (e.g., used in MRI applications).

Nitrogen NF

Chemical Formula: N_2

Example Applications:
Inert component in many gas mixtures; inert displacement medium for pharmaceutical equipment and containers; propellant in pressurized aerosol dispensers; coolant for carbon dioxide surgical lasers; source of pneumatic pressure to power gas-operated medical devices.

See Pure Gas Section For Transport Information (page B•65)



Color Code			
Shoulder	Black	Black	Black
Body	Black	Black DIN: 02014494	

Nitrogen NF

Part Number	Specification	Cylinder Style/ CGA Connection	Content (ft^3/m^3)	Pressure (psig/bar)
NI M-T	N_2: ≥ 99.0% O_2: < 1.0% Odor: None	T/580	304/8.43	2,640/183
NI M-K		K/580	228/6.32	2,200/154
NI M-E		ME/960	23/0.65	2,000/154
NI M-D		MD/960	14/0.39	2,000/154

Nitrogen NF Cryogenic Liquid

Part Number	Specification	Cylinder Style/ CGA Connection	Content (ft^3/m^3)	Pressure (psig/bar)
NI MLC230-22	Same specifications as above	230 L/Gas 580, Liquid 295	5,023/140	22/1.5
NI MLC180-22		180 L/Gas 580, Liquid 295	4,099/113	22/1.5
NI MLC180-230		180 L/Gas 580, Liquid 295	4,099/113	230/16
NI MLC160-22		160 L/Gas 580, Liquid 295	3,519/98	22/1.5
NI MLC160-230		160 L/Gas 580, Liquid 295	3,519/98	230/16

Higher purities (NI 4.8M and NI 5.0M) also available for NF-grade gas and cryogenic liquid.

Oxygen USP

Chemical Formula: O_2

Example Applications: First aid treatment of emergencies such as suffocation and heart attacks; treatment of patients with respiratory disorders; anaesthesia; hyperbaric oxygen chambers; specialized oxygen therapies; oxidizing agent in pharmaceutical synthesis.

See Pure Gas Section For Transport Information (page B•70)



Color Code			
Shoulder	Green	White	Green
Body	Green	Green DIN: 02014408	

Oxygen USP

Part Number	Specification	Cylinder Style/ CGA Connection	Content (ft^3/m^3)	Pressure (psig/bar)
OX M-T	O_2: ≥ 99.0% Odor: None	T/540	337/9.35	2,640/183
OX M-K		K/540	249/6.90	2,200/154
OX M-E		ME/870	25/0.69	2,000/154
OX M-AE		AE/870	24/0.66	2,000/139
OX M-D		MD/870	15/0.41	2,000/154
OX M-AD		AD/870	15/0.41	2,000/139
OX M-EGNGVNTG		ME/Regulator included	25/0.69	2,000/154
OX M-AEGNGVNTG		ME/Regulator included	24/0.66	2,000/139
OX M-DGNGVNTG		MD/Regulator included	15/0.41	2,000/139
OX M-AEGNGOPTI*		AE/Regulator included	24/0.66	2,000/139
OX M-AEGNGDIGIT		AE/Regulator included	24/0.66	2,000/139

* Expected availability 2015.

Oxygen USP Cryogenic Liquid

Part Number	Specification	Cylinder Style/ CGA Connection	Content (ft^3/m^3)	Pressure (psig/bar)
OX ML230-22	Same specifications as above	230 L/Gas 540, Liquid 440	5,930/165	22/1.5
OX ML230-230		230 L/Gas 540, Liquid 440	5,930/165	230/16
OX ML180-22		180 L/Gas 540, Liquid 440	4,844/135	22/1.5
OX ML180-230		180 L/Gas 540, Liquid 440	4,844/135	230/16
OX ML160-22		160 L/Gas 540, Liquid 440	4,350/121	22/1.5
OX ML160-230		160 L/Gas 540, Liquid 440	4,350/121	230/16

Carbon Dioxide USP

Chemical formula: CO_2

Example Applications: Operation of artificial organs under close-to-physiologic atmospheres; cryosurgery with insufflators during laparoscopy; respiratory stimulant in mixtures with oxygen or air to promote deep breathing; back-up refrigeration for mechanical freezer failure.

See Pure Gas Section For Transport Information (page B•35)



Color Code			
Shoulder	Gray	Gray	Gray
Body		Gray	Aluminum
		DIN: 02014459	

Carbon Dioxide USP

Part Number	Specification	Cylinder Style/ CGA Connection	Content (lb/kg)	Pressure (psig/bar)
CD M-64	CO_2: ≥ 99.0%	64 lb/320	64/29.02	830/57
CD M-50		K/320	50/22.73	830/57
CD M-50S		50 lb/320	50/22.73	830/57
CD M-20		20 lb/320	20/9.09	830/57
CD M-E		ME/940	6/2.95	830/57
CD M-D		MD/940	4.0/1.81	830/57

Carbon Dioxide USP Refrigerated Liquid

Part Number	Specification	Cylinder Style/ CGA Connection	Content (lb/kg)	Pressure (psig/bar)
CD MLC180-350	Same specifications as above	180 L/Gas 320, Liquid 622	400/182	350/24
CD MLC170-350		170 L/Gas 320, Liquid 622	375/172	350/24

Cylinders with a full length eductor tube to permit withdrawal of liquid phase product are available on request.

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Making our planet more productive

Mixture Product Summary

The following mixture product summary represents the most common medical mixtures and applications in the healthcare industry. Praxair can accommodate most customer requests and specialized needs.

Depending on the specific mixture, FDA investigation on new drug approval and/or a physician's independent and institutional review board approval may be required for any investigational mixture to be used in humans.

In Canada, a physician must obtain approval from the Special Access Program of Health Canada in order for Praxair to supply gases to be used as drugs that have not been registered with a D.I.N. (Drug Identification Number).

Accordingly preparation of specific mixtures are subject to prior approval by Praxair.

Gas Mixture Components for Medical Mixtures

USP-NF Grades	Non-USP-NF Grades
Nitrogen (N_2)	Acetylene (C_2H_2)
Carbon Dioxide (CO_2)	Carbon Monoxide (CO)
Helium (He)	Hydrogen (H_2)
Nitrous Oxide (N_2O)	Methane (CH_4)
Oxygen (O_2)	Neon (Ne)

Part Number	Major Application and Mixture Description	Cylinder Style	CGA	Contents* ft³/m³
	Therapy – Medical Drug Gases			
MM OXCD5-K	Carbon Dioxide 5%/Oxygen	K	280	230/6.53
MM OXCD10-K	Carbon Dioxide 10%/Oxygen	K	500	235/6.68
MM HEOX20-K	Oxygen 20%/Helium	K	280	199/5.63
MM HEOX30-K	Oxygen 30%/Helium	K	280	199/5.65
MM HEOX30-AEGNG	Oxygen 30%/Helium	AE	Regulator included	21/0.69
MM HEOX20LCQ-K	Oxygen 20%/Helium	K	Regulator included	217/6.15
	Diagnostic – Medical Device Gases			
	Lung Diffusion for Pulmonary Function Studies			
LD CO1-K	Carbon Monoxide 0.3%, Helium 10%, Oxygen 21%/Nitrogen	K	500	209/5.90
LD NE1-K	Carbon Monoxide 0.3%, Neon 0.5%, Oxygen 21%/Nitrogen	K	500	212/6.01
LD ME1C-K	Carbon Monoxide 0.3%, Methane 0.3%, Oxygen 21%/Nitrogen	K	500	212/6.01
LD AC2C-K	Acetylene 0.3%, Carbon Monoxide 0.3%, Methane 0.3%, Oxygen 21%/Nitrogen	K	500	213/6.02
	Blood Gas Analysis			
**	Carbon Dioxide 2-14%/Nitrogen	K	500	211/5.96
**	Carbon Dioxide 7-12%/Oxygen	K	500	233/6.59
**	Oxygen 1-19%/Nitrogen	K	500	209/5.92
**	Carbon Dioxide 2-12%, Oxygen 12-25%/Nitrogen	K	500	212/6.01

* Approximate contents; actual contents will vary by concentration.
** Contact your local Praxair representative for specific part numbers.

Diagnostic gas mixtures are typically ordered as certified standards, but can also be produced to meet primary standard grade. For applications that do not require a reported analysis, such as biological atmospheres and medical laser gases, non-certified grades are typically ordered.

Medical Gas Mixtures Cylinder Valve

Mixtures	Outlet Connections	
	Yoke	Threaded
Carbon Dioxide & Oxygen (CO_2 not over 7%)	880	280
Carbon Dioxide and Oxygen (CO_2 over 7%)	940	500
Carbon Dioxide, Oxygen, Nitrogen	973	500
Clinical Blood Gas Mixtures	973	500
Gas Mixtures, Medical* Flammable	981	350
Gas Mixtures, Medical* Nonflammable, Noncorrosive	973	500

* Gas mixtures labeled as drugs or medical devices and not having another connection assignment.

Mixtures	Outlet Connections	
	Yoke	Threaded
Helium and Oxygen (He not over 80%)	890	280
Helium and Oxygen (He over 80%)	930	500
Lung Diffusion Mixtures	973	500
Nitrous Oxide and Oxygen (N_2O 47.5 to 52.5%)	965	280
Nitrogen and Oxygen (O_2 over 23.5%)	890	280
Oxidizing Mixtures	977	296

Windows and Doors

Overview

A Window and Door Team Driven by Your Needs

Praxair is more than just gases. We have a wide range of services that help create value and improve the competitiveness of window and door manufacturers around the world. Praxair has been working with the industry for years, developing advanced technologies that improve energy efficiency and product quality.

Praxair's window and door technology team is composed of engineering and market specialists who are focused on our customers' goals and challenges. The team works with industry consultants, engineering companies, and educators to develop better technologies for the industry. We help you specify, start-up, and optimize each system we offer. The result is an integrated, well-planned, and more efficient system and specialty gas supply meeting your needs.

Praxair offers a wide range of gas production and storage systems options for window and door manufacturers, including cryogenic, pressure swing adsorption, membrane, and bulk liquid. Together we work to achieve one goal; to provide you with the most cost-effective supply method.

Comprehensive Product Range
Supplying each application with the proper gas (grade, compliance, certification, scale).

Consistent Reliability
Ensuring high quality products are there when they are needed.

Equipment and Systems Excellence
Connecting customers with everything needed to handle and store gases efficiently and safely.

Productivity and Innovation Partner
Working with the glass industry to identify and implement productivity and cost improvements.

Ease of Doing Business
Providing convenient e-commerce options and strong customer support.

Safety Focus
Making safety the top priority for every activity.

PRAXAIR
Making our planet more productive

Filling insulated glass units with an Optigas® II Gas Fill System can enable window manufacturers to qualify for Energy Star 2015 and Energy Star Best-in-Class ratings at lower cost.

The Optigas II System can precisely fill insulated glass with the right mixtures of Argon and just enough Krypton needed to meet your target U value with significantly less waste as compared to other fill systems that can lose 50% or more of the Krypton being filled. You can gain an extra U value point or more without having to use alternative higher cost options. With Praxair's consistent, reliable supply of affordable krypton you can count on a low cost solution. And with Optigas ThermalCert built in, you will be able to verify the gas content to your customers.

The OptiGas II System also includes IAS Fast-Gas capabilities that provide a fast Argon fill system. So there is no need to have separate fill machines for Krypton and Argon, the OptiGas II System does it all.

Developed jointly by Praxair and Integrated Automation Systems, the OptiGas II System employs innovative technologies that give you precise control of the filling process – practically eliminating the waste common with existing systems – and enables you to cost effectively (and reliably) use krypton and krypton/argon mixes in more of your product lines. The result is a measurable competitive advantage for your operation because achieving more desirable U value targets means you can produce windows at a much lower gas cost.

OptiGas II System Key Benefits

Automated – Units are filled with the proper gas, in the specified proportion, without manual intervention or having to change design, manufacturing processes or use higher cost alternatives.

Reliable – As one of the world's largest manufacturers of Krypton, Praxair can offer reliable supply at reasonable and predictable prices.

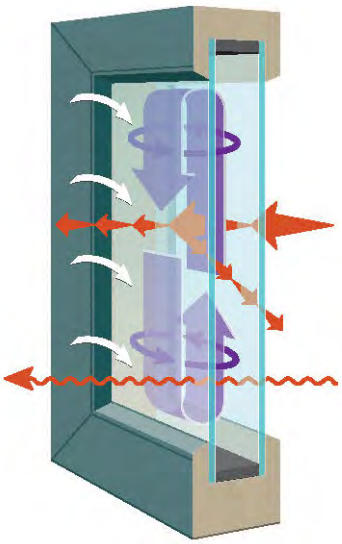
Accurate – Precise gas-fill control consistently achieves more accurate fill content with less waste than traditional filling.

High Yielding – By practically eliminating Krypton waste, the OptiGas II System reduces gas usage by half or more per window.

Tunable – You'll be able to target the most effective Krypton-Argon ratio for each unit, to achieve an optimum U value.

Flexible – The OptiGas II System can be run as a stand-alone unit or integrated with FeneVision or other ERP or production software. The OptiGas II System can fill Krypton or Argon quickly and consistently.

Verifiable – With the built in ThermalCert quality control module you'll be able to verify gas content to your customers and provide verification data in case of audit.



Gas Handling Equipment

Section

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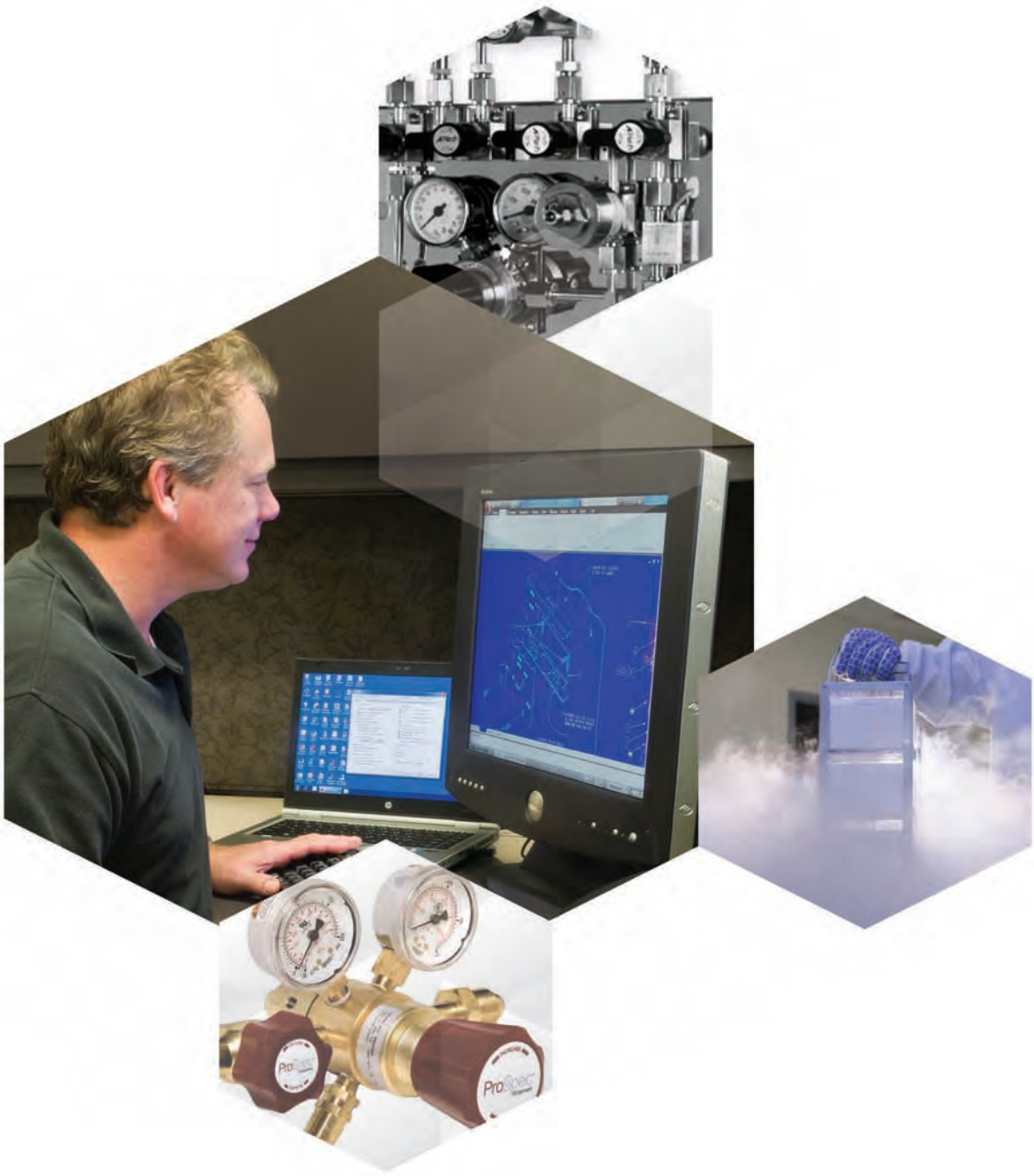

In this section

- **Thousands of Gas Handling Solutions**

- **Fast, reliable supply**
- **Full product line, including our new *ProSpec*™ equipment**

Regulators

Regulator Summary and Reference Guide

Regulator Summary

Critical Purity – 4000 Series Regulators
These stainless steel and brass regulators are recommended where purity and contamination requirements are important. They are most often used with Critical Purity Gases (greater than 99.9995% or purity grade 5.5) and Toxic or Flammable gases, where vent lines are required from the regulator. The 4000 Series regulators are available for both corrosive and non-corrosive service.

High Purity – 3000 Series Regulators
These nickel-plated brass/stainless steel regulators are recommended for applications where diffusion resistance is an important factor in ensuring purity. They provide the same features as the 4000 series with the exception of the relief valve. This series is most often used with high purity gases (equal to 99.999% or purity grade 5.0). The 3000 Series regulators are available for both corrosive and non-corrosive service.

High Purity Economical – 2000 Series Regulators
These chrome-plated brass regulators have similar features to the 3000 Series with a few specific design characteristics. They are most often used with high purity gases (less than 99.999% or purity grade 5.0) when higher flow rates are required and cost is the most important issue. The 2000 Series regulators are available for non-corrosive service.

Special Purpose Regulators
These regulators incorporate quality features from all of the above series. They have been designed with special features for specific applications.

This Regulator Reference Guide *will assist you in the appropriate selection of a Specialty Gas regulator. We have provided a "Series" recommendation for each pure gas offered in this catalog. Within each Series select which model best suits your needs using the selection and reference guidelines. If you have any questions, contact your local Praxair Specialty Gases representative or Customer Service Center.*

Reference Guide

Critical Purity – 4000 Series

Non-Corrosive Models	Regulator Type	Page
4012 Series	Dual Stage	E•244
4002 Series	Single Stage	E•245
4005 Series	Line Regulator	E•246
Corrosive Models	**Regulator Type**	**Page**
4032 Series	Dual Stage	E•247
4022 Series	Single Stage	E•248
4025 Series	Line Regulator	E•249

High Purity – 3000 Series

Non-Corrosive Models	Regulator Type	Page
3012 Series	Dual Stage	E•250
3002 Series	Single Stage	E•251
3004 Series	Line Regulator	E•252
Corrosive Models	**Regulator Type**	**Page**
3032 Series	Dual Stage	E•253
3022 Series	Single Stage	E•254
3024 Series	Line Regulator	E•255

High Purity Economical – 2000 Series

Non-Corrosive Models	Regulator Type	Page
2012 Series	Dual Stage	E•256
2002 Series	Single Stage	E•257
2005 Series	Line Regulator	E•258

General Purpose

Non-Corrosive Models	Regulator Type	Page
120 Series	Single Stage	E•259
100 Series	Dual Stage	E•259
1009-65 Series	Single Stage	E•260
1009-75 Series	Dual Stage	E•260

Special Purpose

Regulator Models	Regulator Type	Page
2006 Series Cryogenic Liquid Cylinder Service	Single Stage	E•261
3025 Series Non-Corrosive Gas in Lecture Bottles	Single Stage	E•262
3026 Series Corrosive Gas in Lecture Bottles	Single Stage	E•262
2010 Series, High Purity/Non-Corrosive	Dual Stage	E•263
4083 and 4085 Series, Critical Purity/ High Flow, Non-Corrosive Service	Single Stage/ Line	E•264
4084 and 4086 Series, Critical Purity/ High Flow, Corrosive Service	Single Stage/ Line	E•265
4092 and 4093 Series High Inlet/Outlet Pressure for Corrosive and Non-Corrosive Service	Piston	E•266
145 Series High Inlet/Outlet Pressure for Corrosive and Non-Corrosive Service	Piston	E•267
4094 and 4095 Series High Pressure/High Flow	Piston	E•268
3013 Series, High Purity for Oxygen Service	Dual Stage	E•269
3003 Series, for Oxygen Service	Single Stage	E•270
3005 Series, Oxygen Line Regulator	Line	E•271
4008 Series High Purity, Corrosive Gas Service	Single Stage	E•272
3008 Series, Electrically Heated Regulator	Single Stage	E•273
170 Series, Low Pressure Line Regulator	Line	E•274
3028 Series Lecture Bottles, Corrosive Service	Single Stage	E•274
4448 Series, Vaporizing Regulator		E•275
3000 Series Flowmeter and Regulator Combinations Corrosive and Non-Corrosive Service	Single and Dual Stage	E•276
300 Series, High Purity/Low Flow for Corrosive and Non-Corrosive Service	Two Stage	E•277
7002, 7003 and 7004 Series Semiconductor Process Gas Regulators	Single Stage	E•278

Most specialty gases are supplied in cylinders compressed to high pressures. Pressure regulators reduce these high pressures to lower pressures that can be safely used in an operating system. Proper regulator selection is critical for both safety and effectiveness of operating systems.

Many variables are involved in selecting the proper pressure regulator. While certainly not a comprehensive list, the following provides some of the more important considerations. To further assist in making proper regulator selections, refer to Section B, Pure Gases or Section C, Mixtures as applicable, of the Praxair Specialty Gases & Equipment reference guide for recommendations.

1 Materials Compatibility
Materials used to construct regulators must be compatible with the gas – especially those materials (wetted parts) in contact with the gas. We offer a wide variety of regulators with various materials of construction to help ensure that the correct regulator is available for your needs. A materials compatibility chart is located on pages G•423 - G•425.

2 Toxicity
Regulators must be designed with vent connectors to permit the attachment of a vent line or disposal system as a precaution, in the unlikely event of a diaphragm failure.

3 Gas Purity
Like all system components, regulators should be selected to protect the purity of the service gas. As an example, regulators with stainless steel diaphragms are recommended for high purity applications because they are more “diffusion-resistant” than those with “rubber-type” diaphragms. For low particulate applications, consideration should be given to selecting regulators with machine welded VCR® connections. Optional helium leak tests also help to ensure the integrity of regulators.

4a Line or Cylinder Regulator
Cylinder regulators as their name implies are connected directly to gas cylinders. Typically offered in both single and two-stage designs, cylinder regulators normally have inlet and delivery pressure gauges.

Line regulators, on the other hand, are used directly in piping systems such as downstream of the manifold or bulk storage vessel. Because inlet pressure in piping systems is normally constant, line regulators are typically single-stage configurations with delivery pressure gauges only.

4b Single or Dual Stage Design
Single stage regulators reduce pressure in one step as gas is consumed. Dual stage regulators are actually two regulators housed in one body. The first regulator (first stage) is non-adjustable and reduces in-coming pressure to an intermediate setting (typically 250 to 300 psig). The second stage is adjustable and reduces intermediate pressure to final desired delivery pressure. Because the second stage sees only relatively minor inlet pressure changes from the first stage, dual stage regulators maintain steady delivery pressure and do not require periodic adjustment. They are well suited for applications where constant delivery pressure is essential.

5 Output Pressure Range
Regulators must be able to reduce pressure to levels compatible with the operating system and consistent with process needs. Our extensive offering of pressure regulators provides numerous choices with delivery pressure ranges available as low as 0-0.5 psig, or as high as 0-6000 psig.

6 Inlet Pressure Rating
Regulators must be able to safely handle incoming gas pressure. Here again, a wide selection is available which includes regulators that handle inlet pressures up to 10,000 psig.

7 Helium Leak Integrity
Helium leak integrity is a measure of how well a regulator prevents gases from leaking into or out of a regulator body. The measured quantity is expressed as a flow rate such as 1×10^{-9} scc/sec He (1 billionth of a cc/sec). In this case, a helium leak integrity rating of 1×10^{-9} would indicate that the regulator would leak enough gas to fill a cubic centimeter every 33 years. If the rating were 1×10^{-3} the regulator would leak enough gas to fill a cubic centimeter in just 17 minutes.

Helium is used as the test gas because it is chemically inert, it’s easy to detect and it’s an extremely small molecule which allows it to pass through the smallest leak. The lower the helium leak specification, the better the regulator will be at preventing leaks into the atmosphere and minimizing contamination from gases outside the regulator body.

8 Other Considerations
Other criteria for consideration include operating temperature, flow requirements, regulatory issues (e.g. medical regulators meeting FDA regulatory standards), special applications, design preferences and cost. Call your local representative for further assistance.

Note:
Regulators are designed to control pressure. Generally they are supplied with gauges that indicate pressure. Regulators do not measure or control flow unless equipped with devices (such as metering valve or flowmeter) specifically designed for those purposes. Contact your local sales representative to find out more about Praxair’s new line of flow monitoring and flow controlling devices.

Regulators

How to Order Praxair Regulators

In accordance with our philosophy of flexible design, Praxair has developed a versatile modular manufacturing system to accommodate any individual requirement. With all the options Praxair offers, listing discrete part numbers for each regulator series would be impossible. Therefore, we have created a part number matrix which allows you to design a regulator to meet the needs of your application.

To complete the part number matrix, consult the Regulator Summary and Reference Guide on page E•241. On this page, you will find a description of each series of Praxair regulators with their recommended application and appropriate gas usage. You may also refer to the Pure Gases section of the Praxair Specialty Gases & Equipment reference guide for equipment recommendations that will help you make the proper selection (see Section B). If you are new to selecting regulators or would like a quick refresher, review steps A through D below. The "quick-find" reference guide on page E•241 will help you identify the catalog page that contains the regulator information you need. If you require additional assistance, please consult your local Praxair sales representative or call Praxair customer service at 1-877-PRAXAIR.

Example
When using the table below to order a 4000 Series 316L stainless steel, single stage cylinder regulator with an **(A)** outlet pressure range of 0-50 psig, a **(B)** 0-4000 psig inlet pressure gauge, a **(C)** diaphragm valve with a 1/4" tube fitting, **(D)** psi/kPa pressure gauges, and a **(CGA)** CGA 580 connection for nitrogen service, the part number would be PRS40222331-580 (see page E•248).

A Select the desired outlet pressure range from those available in the A column. The selection of an outlet pressure range automatically specifies the outlet pressure gauge which appears in the adjacent column. For example, a regulator with a 0-250 psig outlet pressure range will have a 0-400 psig pressure gauge installed.

B Choose the inlet pressure gauge from those available in the B column. While the most common cylinder pressure is between 2200 psig and 2400 psig, several gases are stored in cylinders at other pressures.

C Indicate the outlet assembly desired from those available in the C column. Since there are a wide variety of tubing and piping systems in use, the matrix accommodates virtually any style of connection, eliminating the need for adapters and reducing potential leak paths. Praxair also offers a choice of valve options for gas flow control.

D Select an assembly option from those available in the D column. A bare body regulator is shipped without peripherals, with all ports open and unplugged. A standard regulator comes completely assembled with all selected peripherals, ready for use.

CGA Specify an inlet connection. On all regulator series, Praxair will provide any CGA, DIN 477, BS 341, or other standard connection provided it is recognized as safe for the materials of construction and pressure rating of the regulator. Consult Praxair for proper selection of the inlet connection. A "000" at the end of the part number indicates inlet connection (1/4" female NPT).

Regulators PRS4022ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig*	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA, DIN 477, BS 341 and others available.
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting	4: Cleanroom Assembly (psi/kPA Gauges)	
5: 0-500 psig	0-1000 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT	5: Cleanroom Assembly (bar/psi Gauges)	
7: 0-150 psig	30"-0-200 psig	8: 0-6000 psig	5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

* Not available with 5500 psig inlet pressure

4012 Regulators

Critical Purity Regulators for Non-Corrosive Service

PRAXAIR
Making our planet more productive

Dual Stage Brass Barstock Body, Six-Port Configuration, 316 Stainless Steel Diaphragm

The 4012 Series regulators are intended for primary pressure control of non-corrosive, critical purity or liquefied gases for applications requiring constant delivery pressure control, regardless of supply pressure.

Typical Applications

- EPA Protocol gases
- Gas and liquid chromatography FID, GC, HID, PID, FPO, RD, ECD
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Petro/Chemical Industry
- Purge gases
- Laboratory analysis

Features and Benefits

- **Brass Barstock Body**
  Controlled surface integrity
- **Front Panel Mountable**
  Easy installation
- **Outlet Pressure Ranges 0-15 to 0-250 psig**
  Broad range of applications
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Pipe Away Relief Valve – 1/4" FNPT**
  Safely vent exhausted gases

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  4500 psig (300 bar) optional
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass chrome-plated
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  0.05
- **Weight**
  5.4 lb (2.5 kg)

Materials

- **Body**
  Brass barstock
- **Bonnet**
  Brass barstock
- **Seat**
  First stage – PTFE Teflon®
  Second stage – CTFE with 4500 psig inlet option
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information – Series PRS4012ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting	4: Cleanroom Assembly (psi/kPa Gauges)	and others
7: 0-150 psig	30"-0-200 psig	8: 0-6000 psig*	4: Diaphragm Valve 1/4" MNPT	5: Cleanroom Assembly (bar/psi Gauges)	available
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

* Maximum inlet pressure 4500 psig (300 bar) with CTFE

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

4002 Regulators

Critical Purity Regulators for Non-Corrosive Service

Single Stage Brass Barstock Body, Six-Port Configuration, 316 Stainless Steel Diaphragm

The 4002 Series regulators are intended for primary pressure control of non-corrosive, critical purity or liquefied gases. It is recommended for applications where minor fluctuations in outlet pressure due to diminishing inlet supply can be tolerated.

Typical Applications

- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control of cryogenic gases

Features and Benefits

- **Brass Barstock Body**
  Controlled surface integrity
- **Front and Rear Panel Mountable**
  Versatile system configuration
  Base mount 10-32 UNF (2)
- **Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Pipe Away Relief Valve – 1/4" FNPT**
  Safely vent exhausted gases
- **Delivery Pressure Range Easily Changed**
  Maximum flexibility

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  4500 psig (300 bar) optional
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass chrome-plated
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  0.1
- **Weight**
  3.8 lb (1.7 kg)

Materials

- **Body**
  Brass barstock
- **Bonnet**
  Brass barstock
- **Seat**
  PFA Teflon®
  CTFE with 4500 psig inlet option
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information – Series PRS4002ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig*	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting	4: Cleanroom Assembly (psi/kPa Gauges)	and others
5: 0-500 psig	0-1000 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT	5: Cleanroom Assembly (bar/psi Gauges)	available
7: 0-150 psig	30"-0-200 psig	8: 0-6000 psig**	5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

* Not available with 4500 psig inlet pressure.
** Maximum inlet pressure 4500 psig (300 bar) with CTFE.

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

4005 Regulators

Critical Purity Regulators for Non-Corrosive Service

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Making our planet more productive

Line Regulator, Single Stage Brass Barstock Body, Four-Port Configuration, 316 Stainless Steel Diaphragm

The 4005 Series regulators are intended for secondary pressure control of non corrosive, critical purity or liquefied gases. It is recommended as point of use pressure control in critical purity gas delivery systems.

Typical Applications

- Bulk gas delivery systems
- Gas and liquid chromatography
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control of cryogenic gases

Features and Benefits

- **Brass Barstock Body**
  Controlled surface integrity
- **Front and Rear Panel Mountable**
  Versatile system configuration
  Base mount 10-32 UNF (2)
- **Outlet Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Pipe Away Relief Valve – 1/4" FNPT**
  Safely vent exhausted gases
- **Delivery Pressure Range Easily Changed**
  Maximum flexibility

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass chrome-plated
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  0.1 (maximum outlet 50 psig or below)
  0.2 (maximum outlet above 50 psig)
- **Weight**
  2.25 lb (1.0 kg)

Materials

- **Body**
  Brass barstock
- **Bonnet**
  Brass barstock
- **Seat**
  PFA Teflon®
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information – Series PRS4005ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	000: 1/4" FNPT
2: 0-50 psig	30"-0-100 psig		1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	TF2: 1/8" Tube
3: 0-100 psig	30"-0-200 psig		2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	TF4: 1/4" Tube
4: 0-250 psig	0-400 psig		3: Diaphragm Valve 1/4" Tube Fitting	4: Cleanroom Assembly (psi/kPa Gauges)	TF6: 3/8" Tube
5: 0-500 psig	0-1000 psig		4: Diaphragm Valve 1/4" MNPT	5: Cleanroom Assembly (bar/psi Gauges)	TF8: 1/2" Tube
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Wall Mount Bracket	PRSSMLR-1	To mount regulator to a wall.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10-8 scc/sec
Reversed Inlet/Outlet Configuration	Contact your Praxair representative	Inlet and outlet ports supplied in a reversed ("mirror image") configuration

4032 Regulators

Critical Purity Regulators for Corrosive Service

Dual Stage 316 Stainless Steel Barstock Body, Six- Port Configuration, 316 Stainless Steel Diaphragm

The 4032 Series regulators are intended for primary pressure control of critical purity and corrosive gases. It is recommended for applications requiring constant delivery pressure control, regardless of supply pressure.

Typical Applications

- EPA Protocol gases
- Gas and liquid chromatography FID, GC, HID, PID, FPO, RD, ECD
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Petro/Chemical Industry
- Purge gases
- Laboratory analysis

Features and Benefits

- **316 Stainless Steel Barstock Body**
  Enhanced corrosion resistance
- **Front Panel Mountable**
  Easy installation
- **Outlet Pressure Ranges 0-15 to 0-250 psig**
  Broad range of applications
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Pipe Away Relief Valve – 1/4" FNPT**
  Safely vent exhausted gases
- **Delivery Pressure Range Easily Changed**
  Maximum flexibility

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  4500 psig (300 bar) optional
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter stainless steel
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  0.05
- **Weight**
  5.4 lb (2.5 kg)

Materials

- **Body**
  316 stainless steel barstock
- **Bonnet**
  316L stainless steel barstock
- **Seat**
  First stage – PTFE Teflon®
  Second stage – CTFE with 4500 psig inlet option
- **Filter**
  10 micron 316 stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information – Series PRS4032ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting	4: Cleanroom Assembly (psi/kPa Gauges)	and others
7: 0-150 psig	30"-0-200 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT	5: Cleanroom Assembly (bar/psi Gauges)	available
		8: 0-6000 psig*	5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

* Maximum inlet pressure 4500 psig (300 bar) with CTFE Seat

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

4022 Regulators

Critical Purity Regulators for Corrosive Service

PRAXAIR
Making our planet more productive

Single Stage 316 Stainless Steel Barstock Body, Six-Port Configuration, 316 Stainless Steel Diaphragm

The 4022 Series regulators are intended for primary pressure control of critical purity and corrosive gases. It is recommended for applications where minor fluctuations in outlet pressure due to diminishing inlet supply can be tolerated.

Typical Applications

- Gas and liquid chromatography
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control of cryogenic gases

Features and Benefits

- **316 Stainless Steel Barstock Body**
  Enhanced corrosion resistance
- **Front and Rear Panel Mountable**
  Versatile system configuration base mount 10-32 UNF (2)
- **Outlet Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Pipe Away Relief Valve – 1/4" FNPT**
  Safely vent exhausted gases
- **Delivery Pressure Range Easily Changed**
  Maximum flexibility

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  4500 psig (300 bar) optional
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter stainless steel
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  0.1
- **Weight**
  3.8 lb (1.7 kg)

Materials

- **Body**
  316 stainless steel barstock
- **Bonnet**
  316 stainless steel barstock
- **Seat**
  PFA Teflon®
  CTFE with 4500 psig inlet option
- **Filter**
  10 micron 316 stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information – Series PRS4022ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig*	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting	4: Cleanroom Assembly (psi/kPa Gauges)	and others
5: 0-500 psig	0-1000 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT	5: Cleanroom Assembly (bar/psi Gauges)	available
7: 0-150 psig	30"-0-200 psig	8: 0-6000 psig**	5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

* Not available with 4500 psig inlet pressure
** Maximum inlet pressure 4500 psig (300 bar) with CTFE Seat.

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

4025 Regulators

Critical Purity Regulators for Corrosive Service

Line Regulator, Single Stage 316 Stainless Steel Barstock Body, 316 Stainless Steel Diaphragm

The 4025 Series regulators are intended for secondary pressure control of critical purity and corrosive gases. It is recommended as a point of use pressure control in critical purity gas delivery systems.

Typical Applications

- Bulk gas delivery systems
- Gas and liquid chromatography
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control of cryogenic gases

Features and Benefits

- **316 Stainless Steel Barstock Body**
  Enhanced corrosion resistance
- **Front and Rear Panel Mountable**
  Versatile system configuration
  Rear mount 10-32 UNF (2)
- **Outlet Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Pipe Away Relief Valve – 1/4" FNPT**
  Safely vent exhausted gases
- **Delivery Pressure Range Easily Changed**
  Maximum flexibility

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter stainless steel
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  0.1 (maximum outlet 50 psig or below)
  0.2 (maximum outlet above 50 psig)
- **Weight**
  2.25 lb (1.0 kg)

Materials

- **Body**
  316 stainless steel barstock
- **Bonnet**
  316 stainless steel barstock
- **Seat**
  PFA Teflon®
- **Filter**
  10 micron 316 stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information — Series PRS4025ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	000: 1/4" FNPT
2: 0-50 psig	30"-0-100 psig		1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	TF2: 1/8" Tube
3: 0-100 psig	30"-0-200 psig		2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	TF4: 1/4" Tube
4: 0-250 psig	0-400 psig		3: Diaphragm Valve 1/4" Tube Fitting	4: Cleanroom Assembly (psi/kPa Gauges)	TF6: 3/8" Tube
5: 0-500 psig	0-1000 psig		4: Diaphragm Valve 1/4" MNPT	5: Cleanroom Assembly (bar/psi Gauges)	TF8: 1/2" Tube
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Wall Mount Kit	PRSSMLR-1	To mount regulator to wall
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10-8 scc/sec
Reversed Inlet/Outlet Configuration	Contact your Praxair representative	Inlet and outlet ports supplied in a reversed ("mirror image") configuration

3012 Regulators

High Purity Regulators for Non-Corrosive Service

PRAXAIR
Making our planet more productive

Dual Stage Nickel-Plated Brass Barstock Body, Four-Port Configuration, 316 Stainless Steel Diaphragm

The 3012 Series regulators are intended for primary pressure control of non-corrosive, high purity or liquefied gases. It is recommended for applications requiring constant delivery pressure control, regardless of supply pressure.

Typical Applications

- EPA Protocol gases
- Gas and liquid chromatography FID, GC, HID, PID, FPO, RD, ECD
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Petro/Chemical Industry
- Purge gases
- Laboratory analysis

Features and Benefits

- **Nickel-Plated Brass Barstock Body**
  Controlled surface integrity
- **Front Panel Mountable**
  Easy Installation
- **10 Micron Filtration**
- **Outlet Pressure Ranges 0-15 to 0-250 psig**
  Broad range of applications
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter
  chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  .05
- **Weight**
  4.8 lb (2.2 kg)

Materials

- **Body**
  Nickel-plated brass barstock
- **Bonnet**
  Nickel-plated brass barstock
- **Seat**
  First Stage – Teflon®
  Second Stage – PTFE
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information — Series PRS3012ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting		and others
7: 0-150 psig	30"-0-200 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT		available
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

3002 Regulators

High Purity Regulators for Non-Corrosive Service

Single Stage Nickel-Plated Brass Barstock Body, Four-Port Configuration, 316 Stainless Steel Diaphragm

The 3002 Series regulators are intended for primary pressure control of non-corrosive, high purity or liquefied gases. It is recommended for applications where minor fluctuations in outlet pressure due to diminishing inlet supply can be tolerated.

Typical Applications

- Gas and liquid chromatography
- High purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control for cryogenic gases

Features and Benefits

- **Nickel-Plated Brass Barstock Body**
  Controlled surface integrity
- **Front and Rear Panel Mountable**
  Versatile system configuration
  Front panel mount
  Base mount 10-32 UNF (2)
- **Outlet Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter
  chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  .05
- **Weight**
  3.2 lb (1.5 kg)

Materials

- **Body**
  Nickel-plated brass barstock
- **Bonnet**
  Nickel-plated brass barstock
- **Seat**
  PFA Teflon®
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information — Series PRS3002ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting		and others
5: 0-500 psig	0-1000 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT		available
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

3004 Regulators

High Purity Regulators for Non-Corrosive Service

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Line Regulator, Single Stage Nickel-Plated Brass Barstock Body, Three-Port Configuration, 316 Stainless Steel Diaphragm

The 3004 Series regulators are intended for secondary pressure control of non-corrosive, high purity or liquefied gases. It is also recommended as a point of use presure control in high purity gas delivery systems.

Typical Applications

- Bulk gas delivery systems
- Gas and liquid chromatography
- High purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control for cryogenic gases

Features and Benefits

- **Nickel-Plated Brass Barstock Body**
  Controlled surface integrity
- **Front and Rear Panel Mountable**
  Versatile system configuration
  Rear mount 10-32 UNF (2)
- **Outlet Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter
  chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.1 (maximum outlet 50 psig or below)
  0.2 (maximum outlet above 50 psig)
- **Weight**
  2.8 lb (1.3 kg)

Materials

- **Body**
  Nickel-plated brass barstock
- **Bonnet**
  Nickel-plated brass barstock
- **Seat**
  PFA Teflon®
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information — Series PRS3004ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	000: 1/4" FNPT
2: 0-50 psig	30"-0-100 psig		1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	TF2: 1/8" Tube
3: 0-100 psig	30"-0-200 psig		2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	TF4: 1/4" Tube
4: 0-250 psig	0-400 psig		3: Diaphragm Valve 1/4" Tube Fitting		TF6: 3/8" Tube
5: 0-500 psig	0-1000 psig		4: Diaphragm Valve 1/4" MNPT		TF8: 1/2" Tube
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Wall Mount Kit	PRSSMLR-1	To mount regulator to a wall
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec

3032 Regulators

High Purity Regulators for Corrosive Service

Dual Stage 316 Stainless Steel Barstock Body, Four-Port Configuration, 316 Stainless Steel Diaphragm

The 3032 Series regulators are intended for primary pressure control of high purity and corrosive gases. It is recommended for applications requiring constant delivery pressure control, regardless of supply pressure.

Typical Applications

- EPA Protocol gases
- Gas and liquid chromatography FID, GC, HID, PID, FPO, RD, ECD
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Petro/Chemical Industry
- Purge gases
- Laboratory analysis

Features and Benefits

- **316 Stainless Steel Barstock Body**
  Enhanced corrosion resistance
- **Front Panel Mountable**
  Easy Installation
- **10 Micron Filtration**
  Failsafe seat performance
- **Outlet Pressure Ranges 0-15 to 0-250 psig**
  Broad range of applications
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter stainless steel
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.05
- **Weight**
  4.8 lb (2.2 kg)

Materials

- **Body**
  316 stainless steel barstock
- **Bonnet**
  316 stainless steel barstock
- **Seat**
  First stage – Teflon®
  Second stage – PTFE
- **Filter**
  10 micron 316 stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information — Series PRS3032ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA*
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections***
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting		and others
7: 0-150 psig	30"-0-200 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT		available
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

3022 Regulators

High Purity Regulators for Corrosive Service

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Single Stage 316 Stainless Steel Barstock Body, Four-Port Configuration, 316 Stainless Steel Diaphragm

The 3022 Series regulators are intended for primary pressure control of high purity and corrosive gases. It is recommended for applications where minor fluctuations in outlet pressure due to diminishing inlet supply can be tolerated.

Typical Applications

- Gas and liquid chromatography
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control of cryogenic gases

Features and Benefits

- **316 Stainless Steel Barstock Body**
  Enhanced corrosion resistance
- **Front and Rear Panel Mountable**
  Versatile system configuration
  Rear mount 10-32 UNF (2)
- **10 Micron Filtration**
  Failsafe seat performance
- **Outlet Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Convoluted diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter stainless steel
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.1
- **Weight**
  3.2 lb (1.5 kg)

Materials

- **Body**
  316 stainless steel barstock
- **Bonnet**
  316 stainless steel barstock
- **Seat**
  PFA Teflon®
- **Filter**
  10 micron 316 stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information – Series PRS3022ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA*
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections***
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting		and others
5: 0-500 psig	30"-1000 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT		available
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

3024 Regulators

High Purity Regulators for Corrosive Service

Line Regulator, Single Stage 316 Stainless Steel Barstock Body, Three-Port Configuration, 316 Stainless Steel Diaphragm

The 3024 Series regulators are intended for secondary pressure control of high purity and corrosive gases. It is also recommended as point of use pressure control in high purity gas delivery systems.

Typical Applications

- Bulk gas delivery systems
- Gas and liquid chromatography
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control
- Control of cryogenic gases

Features and Benefits

- **316 Stainless Steel Barstock Body**
  Enhanced corrosion resistance
- **Front and Rear Panel Mountable**
  Versatile system configuration
  Rear mount 10-32 UNF (2)
- **Outlet Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Convoluted diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter stainless steel
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.1
- **Weight**
  3.2 lb (1.5 kg)

Materials

- **Body**
  316 stainless steel barstock
- **Bonnet**
  316 stainless steel barstock
- **Seat**
  PFA Teflon®
- **Filter**
  10 micron 316 stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  Teflon®

Ordering Information – Series PRS3024ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	000: 1/4" FNPT
2: 0-50 psig	30"-0-100 psig		1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	TF2: 1/8" Tube
3: 0-100 psig	30"-0-200 psig		2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	TF4: 1/4" Tube
4: 0-250 psig	0-400 psig		3: Diaphragm Valve 1/4" Tube Fitting		TF6: 3/8" Tube
5: 0-500 psig	0-1000 psig		4: Diaphragm Valve 1/4" MNPT		TF8: 1/2" Tube
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Wall Mount Kit	PRSSMLR-1	To mount regulator to a wall.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec

2012 Regulators

High Purity Economical Regulators

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Dual Stage Chrome-Plated, Five-Port Configuration, 316L Stainless Steel Diaphragm

The 2012 Series regulators are intended for primary pressure control of non-corrosive, high purity or liquefied gases. It is recommended for applications requiring constant delivery pressure control, regardless of supply pressure.

Typical Applications

- Gas supply purging
- Gas system charging
- Fuel gas supply control
- Calibration gas control
- Gas Chromatography
- Mass Spectrometers
- INST calibrators
- Purging systems
- Carrier gases
- BTU analyzers
- Non corrosive gas mixtures for analytical instrumentation

Features and Benefits

- **Chrome-Plated Barstock Body**
  Economical high purity design
- **High Flow Capacity**
  Supply multiple use locations
- **Outlet Pressure Ranges 0-15 to 0-200 psig**
  Broad range of applications
- **Stainless Steel Diaphragm**
  No inboard diffusion
- **Large Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Gauges**
  2-1/2" diameter chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.15
- **Weight**
  6 lb (2.7 kg)

Materials

- **Body**
  Chrome-plated forged brass
- **Bonnet**
  First stage – Die cast zinc
  Second stage – Chrome plated die-cast zinc
- **Seat**
  First stage – PTFE Teflon®
  Second stage – PTFE®
- **Filter**
  10 micron, sintered bronze
- **Diaphragm**
  Stainless steel
- **Internal Seals**
  Viton®

Ordering Information – Series PRS2012ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-40 psig	0-60 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-120 psig	0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-200 psig	0-400 psig	6: 0-400 psig	3: Diaphragm Valve 1/4" Tube Fitting		and others
			4: Diaphragm Valve 1/4" MNPT		available
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

2002 Regulators

High Purity Economical Regulators

Single Stage Chrome-Plated, Five-Port Configuration, 316L Stainless Steel Diaphragm

The 2002 Series regulators are intended for primary pressure control of non-corrosive, high purity or liquefied gases. It is recommended for applications where minor fluctuations in outlet pressure due to diminishing inlet supply pressure can be tolerated.

Typical Applications

- Gas supply purging
- Gas system charging
- Fuel gas supply control
- Calibration gas control
- Atomic absorption acetylene

Features and Benefits

- **Chrome-Plated Barstock Body**
  Economical high purity design
- **High Flow Capacity**
  Supply multiple use locations
- **Outlet Pressure Ranges 0-15 to 0-200 psig**
  Broad range of applications
- **Stainless Steel Diaphragm**
  No inboard diffusion
- **Large Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Gauges**
  2-1/2" diameter
  chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.17
- **Weight**
  4.25 lb (1.9 kg)

Materials

- **Body**
  Chrome-plated brass
- **Bonnet**
  Chrome-plated die-cast zinc
- **Seat**
  PTFE Teflon®
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  Stainless steel
- **Internal Seals**
  Viton®

Ordering Information – Series PRS2002ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-40 psig	0-60 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-120 psig	0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-200 psig	0-400 psig	6: 0-400 psig	3: Diaphragm Valve 1/4" Tube Fitting		and others
5: 0-15 psig*	0-30 psig		4: Diaphragm Valve 1/4" MNPT		available
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

* With red line for acetylene use.

Option	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

2005 Regulators

High Purity Economical Regulators

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Line Regulator, Single Stage Chrome-Plated, Four-Port Configuration, 316L Stainless Steel Diaphragm

The 2005 Series regulators are intended for secondary pressure control of non-corrosive, high purity or liquefied gases. It is also recommended as point of use pressure control in high purity gas delivery systems.

Typical Applications

- Point of use laboratory systems
- Gas supply purging
- Liquefied hydrocarbon gas control
- Control of cryogenic gases
- Bulk gas distribution systems

Features and Benefits

- **Chrome-Plated Barstock Body**
  Economical high purity design
- **High Flow Capacity**
  Supply multiple use locations
- **Outlet Pressure Ranges 0-15 to 0-200 psig**
  Broad range of applications
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Large Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Gauges**
  2-1/2" diameter
  chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.17
- **Weight**
  3.1 lb (1.4 kg)

Materials

- **Body**
  Chrome-plated brass
- **Bonnet**
  First stage –
  Chrome plated forged brass
  Second stage –
  Chrome plated die-cast zinc
- **Seat**
  First stage – PTFE Teflon®
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  Stainless steel
- **Internal Seals**
  Viton®

Ordering Information – Series PRS2005ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	000: 1/4" FNPT
2: 0-40 psig	0-60 psig		1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	TF2: 1/8" Tube
3: 0-120 psig	0-200 psig		2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	TF4: 1/4" Tube
4: 0-200 psig	0-400 psig		3: Diaphragm Valve 1/4" Tube Fitting		TF6: 3/8" Tube
7: 0-15 psig	0-30 psig*		4: Diaphragm Valve 1/4" MNPT		
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

* With red line acetylene use.

Option	Part Number	Description
Reversed Inlet/Outlet Configuration	Contact your Praxair representative.	Inlet and outlet ports supplied in a reversed (“mirror image”) configuration.

100 and 120 Regulators

General Purpose Regulators

120 Series – General Purpose, High Flow Two Stage Regulator

The 120 Series is an economical instrument regulator, for use where precise pressure control is required. It is recommended for non-corrosive gases, for general plant and laboratory applications.

Features and Benefits

- **Preset Safety Relief Valve** Helps prevent pressure buildup in second stage
- **Large Diaphragms** Helps provide precise control
- **Needle Valve** Controls gas flow

Specifications

- **Inlet Pressure** 3000 psig
- **Temperature Range** -40 °F to 140 °F (-40 °C to 60 °C)
- **Cv** .15
- **Body Ports** 1/4" FNPT
- **Gauges** 2-1/2"

Materials

- **Body** Forged brass
- **Diaphragm** 316L stainless steel
- **Seats and Seals** PTFE/Viton®
- **Bonnet** Chrome-plated die cast
- **Needle Valve** Forged brass

Ordering Information

Part Number	Delivery Pressure Ranges	Outlet Gauges	Inlet Gauges
PRS1201-CGA	2-15 psig	0-30 psig	4000 psig
PRS1202-CGA	4-80 psig	0-100 psig	4000 psig
PRS1203-CGA	5-125 psig	0-200 psig	4000 psig

100 Series – General Purpose, Single Stage Regulator

The 100 Series is an economical single stage regulator with high flow capabilities. It can be used for the same applications as a 120 Series where a slight variation in delivery pressure can be tolerated.

Features and Benefits

- **Preset Safety Relief Valve** Helps prevent pressure buildup
- **2" Stainless Steel Diaphragm** Sensitive pressure control
- **Needle Valve** Controls gas flow

Specifications

- **Inlet Pressure** 3000 psig
- **Temperature Range** -40 °F to 140 °F (-40 °C to 60 °C)
- **Cv** .15
- **Body Ports** 1/4" FNPT

Materials

- **Body** Forged brass
- **Diaphragm** Stainless steel
- **Seats and Seals** PTFE/Viton®
- **Bonnet** Chrome-plated die cast

Ordering Information

Part Number	Delivery Pressure Ranges	Outlet Gauges	Inlet Gauges
PRS1001-CGA	2-15 psig	0-30 psig	0-4000 psig
PRS1002-CGA	4-80 psig	0-100 psig	0-4000 psig
PRS1003-CGA	5-125 psig	0-200 psig	0-4000 psig

Option – 120 and 100 Series	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

1009 Regulators

General Purpose Regulators

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Single and Dual Stage Barstock Body, Five-Port Configuration, Teflon®-Coated

The 1009 Series regulators are intended for pressure control of general purpose laboratory gases with applications requiring constant delivery pressure, regardless of supply pressure.

Typical Applications

- Purging
- Pressure testing
- Blanketing
- Chamber pressurization
- Liquefied hydrocarbon gas control
- Control for cryogenic gases

Features and Benefits

- **Brass Forged Body**
  Economical high purity design
- **10 Micron Filtration**
  Failsafe performance
- **Pressure Ranges**
  0-15 to 0-200 psig
  Broad range of applications
- **Neoprene Diaphragm**
  Sensitive to downstream conditions
- **Forged Brass Body**
  Durable, long-lasting construction
- **High Flow Capacity**
  Supply multiple use locations

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Gauges**
  2-1/2" diameter
  chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.15 (dual stage)
  0.17 (single stage)
- **Weight**
  4.6 lb (2.1 kg) – dual stage
  3.8 lb (1.7 kg) – single stage

Materials

- **Body**
  Chrome plated forged brass
- **Bonnet**
  Chrome-plated die cast zinc
- **Seat**
  PTFE
- **Filter**
  10 micron Sintered bronze
- **Diaphragm**
  Neoprene
- **Internal Seals**
  PTFE

Ordering Information – Series PRS100975 (Dual Stage) and Series PRS100965 (Single Stage)*

Part Number	Outlet Pressure	Outlet Gauge	Inlet Gauge	Outlet Assemblies
PRS10097501-CGA	0-15 psig	0-30 psig	0-4000 psig	1/4" Tube Fitting
PRS10097502-CGA	0-15 psig	0-30 psig	0-4000 psig	Needle Valve 1/4" MNPT
PRS10097504-CGA	0-40 psig	0-60 psig	0-4000 psig	1/4" Tube Fitting
PRS10097505-CGA	0-40 psig	0-60 psig	0-4000 psig	Needle Valve 1/4" MNPT
PRS10097512-CGA	0-120 psig	0-200 psig	0-4000 psig	1/4" Tube Fitting
PRS10097513-CGA	0-120 psig	0-200 psig	0-4000 psig	Needle Valve 1/4" MNPT
PRS10097520-CGA	0-200 psig	0-400 psig	0-4000 psig	1/4" Tube Fitting
PRS10097521-CGA	0-200 psig	0-400 psig	0-4000 psig	Needle Valve 1/4" MNPT

* Note: Replace 75 with 65 for Single Stage

Option	Part Number	Description
Protocol Station	Add Letter “M” after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter “C” after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter “G” after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter “A” after CGA	See page E•283 for details
Deep Purge	Add Letter “D” after CGA	See page E•279 for details

2006 Regulators

Special Purpose Regulators for Liquid Containers

Single Stage Chrome-Plated Forged Brass Body, 316L Stainless Steel Diaphragm, Liquid Cylinder Regulator

The 2006 Series regulators are intended for primary pressure control of gases supplied in cryogenic liquid cylinders.

Typical Applications

- Argon
- Nitrogen
- Oxygen
- Carbon Dioxide
- Certain Halocarbons

Features and Benefits

- **Designed for Low Inlet Pressures**
  Optimized flow with liquid cylinders
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Forged Brass Body**
  Durable, long-lasting construction
- **Large Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Gauges**
  2-1/2" diameter chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.17
- **Weight**
  3.1 lb (1.4 kg)

Materials

- **Body**
  Chrome plated forged brass
- **Bonnet**
  First stage –
  Chrome plated die-cast
  Second stage –
  Chrome plated die-cast zinc
- **Seat**
  PTFE
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  Stainless steel
- **Internal Seals**
  Viton®

Ordering Information – Series PRS2006ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-40 psig	0-60 psig		1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-120 psig	0-200 psig		2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	BS 341
4: 0-200 psig	0-400 psig		3: Diaphragm Valve 1/4" Tube Fitting		Limited by gas service
			4: Diaphragm Valve 1/4" MNPT		
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

3025 and 3026 Regulators

High Purity Regulators for Lecture Bottles

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3025 Regulator – Single Stage Chrome-Plated Brass Barstock Body, 316L Stainless Steel Diaphragm, Lecture Bottles

The 3025 Series regulators are designed for use with non-corrosive gases in lecture bottles.

Typical Applications

- Universities
- Chemical research
- Pharmaceutical manufacturing

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Gauges**
  1-1/2" diameter
  chrome-plated brass
- **Ports**
  1/8" FNPT
  (1/4" FNPT relief valve)
- **Outlet Pressure Rise**
  Less than .3 psig per
  100 psi inlet decay
- **Cv**
  0.02
- **Weight**
  2.3 lb (1.0 kg)

Materials

- **Body**
  Chrome-plated brass barstock
- **Bonnet**
  Chrome-plated die-cast zinc
- **Seat**
  PTFE
- **Filter**
  10 micron 316L stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  PTFE

Ordering Information — Series PRS3025ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/8" FPT Port	1: Standard Assembly (psi/kPa Gauges)	CGA 170
2: 0-50 psig	0-100 psig	3: 0-4000 psig	1: 1/4" MPT		
			5: Needle Valve 1/8" MPT		

3026 Regulator – Single Stage 316L Stainless Steel Lecture Bottle Regulator

The 3026 Series regulators are designed for use with corrosive gases in lecture bottles.

Typical Applications

- Universities
- Chemical research
- General laboratories

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Gauges**
  2" stainless steel
- **Outlet Pressure Rise**
  Less than .3 psig per
  100 psi inlet decay
- **Cv**
  .05

Materials

- **Body**
  316L stainless steel
- **Bonnet**
  Chrome-plated brass barstock
- **Seat/Seals**
  Teflon® and PCTFE
- **Filter**
  10 micron
- **Diaphragm**
  316 stainless steel

Ordering Information – Series PRS3026ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-30 psig	0-60 psig	3: 0-4000 psig	1: 1/4" FPT Port	1: Standard Assembly (psi/kPa Gauges)	CGA 170
2: 0-60 psig	0-100 psig		5: Needle Valve		CGA 180
3: 0-100 psig	0-200 psig				

2010 Regulators

High Purity Economical Regulator

Dual Stage Forged Brass Low Delivery Pressure Regulator, Four-Port Configuration, Neoprene Diaphragms

The PRS2010 Series regulators are intended for primary pressure control of non-corrosive, high purity, non-liquified gases. It is recommended for applications requiring consistent, very low delivery pressure, from a high pressure source.

Typical Applications

- Gas supply purging
- Purging systems
- Delivery pressures below 5 psig
- Low pressure blanketing
- Laboratory point of use control
- Low delivery pressure with high pressure cylinders

Note: Not for use in hydrogen, methane, and helium. Seals and diaphragms are not sufficient to prevent leakage and permeation of the above gases.

Features and Benefits

- **Forged Brass Body/Bonnet**
  Economical high purity design
- **Medium Flow Capacity**
  Low droop under flow
- **Neoprene Diaphragms**
  Sensitive low pressure adjustments

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -20 ºF to 120 ºF
  (-30 ºC to 50 ºC)
- **Gauges**
  2-1/2" diameter chrome-plated brass
- **Weight**
  6.8 lb
- **Ports**
  ¼" FNPT
- **Helium Leak Integrity**
  3 X 10^{-3} cc/sec He
- **Cv**
  0.08
- **Outlet Valve**
  Needle valve – brass forged

Materials

- **Body**
  Forged brass
- **Bonnet – Forged**
  First stage – Brass
  Second stage – Brass
- **Seats**
  Neoprene
- **Inlet Filter**
  10 micron bronze
- **Diaphragms**
  Neoprene
- **Internal Seals**
  Neoprene

Ordering Information – Series PRS2010ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-1 psig	0-20 oz/in²	3: 0-4000 psig	0: 1/4" FNPT Port	1: Standard Assembly (psig)	CGA and others available
2: 0-2 psig	0-5 psig	5: 0-1000 psig	5: Needle Valve		
3: 0-5 psig	0-15 psig	6: 0-400 psig	9: Diaphragm Valve 1/4" FNPT		

Options	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details

4083 and 4085 Regulators

Critical Purity High Flow Regulators for Non-Corrosive Service

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Single Stage Regulator, Brass Barstock Body, 316 Stainless Steel Diaphragm,

Four-Port Configuration (4083 Series Line Regulator)

Six-Port Configuration (4085 Series Single Stage Regulator)

The 4083 (Line) and 4085 (Single Stage) Series regulators can be used in many different applications including high flow purging, semiconductor manufacturing, manifolds and line regulation.

Typical Applications

- High flow applications
- Bulk gas delivery systems
- Gas and liquid chromatography
- High purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control

Features and Benefits

- **Brass Barstock Body**
  Smooth surface finish
- **Front and Rear Panel Mountable**
  Versatile system configuration
- **Base Mount**
  1/4" - 20 UNC
- **Pressure Ranges 0-15 to 0-250 psig**
  Broad range of applications
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Balanced Stem Seat**
  Constant delivery pressure at high flow
- **Low Wetted Surface Area**
  Minimal purge requirements at high flow

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass
- **Ports**
  1/2" FNPT (inlet/outlet)
  1/4" FNPT (gauges)
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  1.0
- **Maximum Flow Rate**
  8000 scfh (3770 Lpm)
- **Weight**
  4.4 lb (2.0 kg)

Materials

- **Body**
  Brass barstock
- **Bonnet**
  Brass barstock
- **Seat**
  CTFE
- **Filter**
  40 micron sintered bronze
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  4083 Series – Teflon®
  4085 Series – Teflon®

For flow curve see page E•411

Ordering Information – Series PRS4083ABCD-CGA (Line Regulator) and Series PRS4085ABCD-CGA (Single Stage Regulator)

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge***	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/2" FNPT Port	0: Bare Body	4083 Series
2: 0-40 psig	0-60 psig	3: 0-4000 psig	1: 1/2" Tube Fitting	1: Standard Assembly (psi/kPa Gauges)	000: 1/2" FNPT
3: 0-120 psig	0-200 psig	5: 0-1000 psig			TF8: 1/2" Tube
4: 0-200 psig	0-400 psig	6: 0-400 psig		2: Standard Assembly (bar/psig Gauges)	
5: 0-250 psig	0-400 psig	7: 0-200 psig			4085 Series CGA, DIN 477, BS 341 and others
		9: 0-600 psig			

* Not applicable to 4083 Series. Always select "0: None"

Option	Part Number	Description
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec
Reversed Inlet/Outlet Configuration	Contact your Praxair representative	Inlet and outlet ports supplied in a reversed ("mirror image") configuration

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4084 and 4086 Regulators

Critical Purity High Flow Regulators for Non-Corrosive Service

Single Stage Regulator, 316 Stainless Steel Barstock Body, 316 Stainless Steel Diaphragm

Four-Port Configuration (4084 Series Line Regulator)

Six-Port Configuration (4086 Series Single Stage Regulator)

The 4084 (Line) and 4086 (Single Stage) Series regulators can be used in many different applications including high flow purging, semiconductor manufacturing, manifolds and line regulation.

Typical Applications

- High flow applications
- Bulk gas distribution systems
- Gas and liquid chromatography
- High purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization
- Liquefied hydrocarbon gas control

Features and Benefits

- **Stainless Steel Barstock Body**
  Smooth surface finish
- **Front and Rear Panel Mountable**
  Versatile system configuration
- **Base Mount**
  1/4" - 20 UNC
- **Pressure Ranges 0-15 to 0-250 psig**
  Broad range of applications
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **316 Stainless Steel Diaphragm**
  No inboard diffusion
- **Balanced Stem Seat**
  Constant delivery pressure at high flow
- **Low Wetted Surface Area**
  Minimal purge requirements at high flow

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass
- **Ports**
  1/2" FNPT (inlet/outlet)
  1/4" FNPT (gauges)
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  1.0
- **Maximum Flow Rate**
  8000 scfh (3770 Lpm)
- **Weight**
  4.4 lb (2.0 kg)

Materials

- **Body**
  316 stainless steel barstock
- **Bonnet**
  316 stainless steel barstock
- **Seat**
  CTFE

For flow curve see page E•411

- **Filter**
  40 micron
  316 stainless steel
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  4084 Series – Teflon®
  4086 Series – Teflon®

Ordering Information — Series PRS4084ABCD-CGA (Line Regulator) and Series PRS4086ABCD-CGA (Single Stage Regulator)

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge***	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/2" FNPT Port	0: Bare Body	4084 Series
2: 0-40 psig	0-60 psig	3: 0-4000 psig	1: 1/2" Tube Fitting	1: Standard Assembly (psi/kPa Gauges)	000: 1/2" FNPT
3: 0-120 psig	0-200 psig	5: 0-1000 psig			TF8: 1/2" Tube
4: 0-200 psig	0-400 psig	6: 0-400 psig		2: Standard Assembly (bar/psig Gauges)	
5: 0-250 psig	0-400 psig	7: 0-200 psig			4086 Series CGA, DIN 477, BS 341 and others available
		9: 0-600 psig			

* Not applicable to 4084 Series. Always select "0: None"

Option	Part Number	Description
Helium Leak Certification	PRS4760002	Inboard helium leak certification to less than 1 x 10^{-8} scc/sec.
Reversed Inlet/Outlet Configuration	Contact your Praxair representative	Inlet and outlet ports supplied in a reversed ("mirror image") configuration.

4092 and 4093 Regulators

High Inlet/Outlet Pressure for Corrosive or Non-Corrosive Gases

PRAXAIR
Making our planet more productive

Piston-Sensed Single Stage Regulator for Ultra High Pressure Service Nickel-Plated Brass Body (4092 Series) 316 Stainless Steel Body (4093 Series)

The 4092 (Nickel-Plated Brass) and 4093 (316 Stainless Steel) Series regulators are intended for primary pressure control of non-corrosive gases at a maximum inlet pressure of 6000 psig.

Typical Applications

- Airplane strut charging
- Research and development laboratories
- Chemical manufacturing
- Aerospace hydraulic systems
- Pharmaceutical manufacturing
- Gauge calibration

Features and Benefits

- **Large Piston Sensors** Safely controls pressure to 6000 psig
- **Barstock Body** Smooth surface finish
- **Front and Rear Panel Mountable** Versatile system configuration
- **Pressure Ranges 0-750 to 0-6000 psig** Broad range of applications
- **Four Port Design** Flexible installation alternatives
- **Low Wetted Surface Area** Minimal purge requirements

Specifications

- **Maximum Inlet Pressure** 6000 psig (420 bar)
- **Temperature Range** -40 °F to 165 °F (-40 °C to 74 °C)
- **Ports** 1/4" FNPT (gauges)
- **Gauges** 2-1/2" diameter chrome-plated brass or 316 stainless steel
- **Cv** .02 – 0-750 psig .06 – 0-2500 psig .12 – 0-6000 psig
- **Weight** 5.9 lb (2.7 kg)

Materials

- **Body** Nickel-plated brass or 316L stainless steel barstock
- **Bonnet** Nickel-plated brass
- **Seat** Vespel®
- **Filter** 10 micron
- **Internal Seals** Viton®

Ordering Information – Series PRS4092ABCD-CGA (Nickel-Plated Brass Body) and Series PRS4093ABCD-CGA (316L Stainless Steel Body)

A		B		C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Pressure**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-750 psig	0-1000 psig	0: 6000 psig (maximum)	None	0: 1/4" FNPT Port	0: Bare Body	CGA,
2: 0-1500 psig	0-4000 psig	3: 3000 psig (maximum)	0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	DIN 477,
3: 0-2500 psig	0-4000 psig	8: 5500 psig (maximum)	0-6000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (psig/BAR Gauges)	BS 341
4: 0-4500 psig*	0-6000 psig	9: 6000 psig (maximum)	0-10,000 psig	5: Needle Valve 1/4" MNPT		and others
5: 0-6000 psig*	0-10,000 psig			6: 1/8" Tube Fitting		available
				7: 3/8" Tube Fitting		

* Not available with 3000 psig maximum inlet pressure.

Option	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

145 Regulators

Special Purpose Regulators

145 Series – Special Purpose, Piston Regulator

The 145 Series is designed for applications requiring inlet pressures up to 6,000 psi. The piston design requires little or no maintenance.

Specifications

- **Inlet Pressure**
  6000 psig
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Body Ports**
  1/4" FNPT
- **Outlet**
  1/4" Tube fitting
- **Gauges**
  2 1/2"
- **CV**
  0.08

Materials

- **Body**
  Chrome plated brass
- **Piston**
  Brass
- **Seats and Seals**
  Urethane seal PCTFE seat
- **Inlet Filter**
  Sintered bronze

Ordering Information

Part Number	Delivery Pressure Ranges	Outlet Gauges	Inlet Gauges
PRS1451-CGA	50-750 psig	1000 psig	7000 psig
PRS1452-CGA	100-1500 psig	2000 psig	7000 psig
PRS1453-CGA	200-3000 psig	4000 psig	7000 psig
PRS1454-CGA	300-4500 psig	6000 psig	7000 psig

Option	Part Number	Description
Protocol Station	Add Letter “M” after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter “C” after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter “G” after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter “A” after CGA	See page E•283 for details
Deep Purge	Add Letter “D” after CGA	See page E•279 for details

4094 and 4095 Regulators

High Pressure/High Flow Regulators for Non-Corrosive Service

PRAXAIR
Making our planet more productive

Piston-Sensed High Flow/High Pressure Service Regulators

Nickel-Plated Brass Body (4094 Series)

316 Stainless Steel Body (4095 Series)

The 4094 (Brass) and 4095 (316 Stainless Steel) Series regulators are intended for primary pressure control of non-corrosive gases.

Typical Applications

- Airplane strut charging
- Research and development laboratories
- Aerospace hydraulic systems
- Pharmaceutical manufacturing
- Gauge calibration

Features and Benefits

- **Large Piston Sensors**
  Excellent sensitivity, balanced valve design assures stable downstream pressure
- **Rear Panel Mountable**
  Versatile system configuration
- **Pressure Ranges 0-750 to 0-1500 psig**
  Broad range of applications
- **Low Wetted Surface Area**
  Minimal purge requirements

Specifications

- **Maximum Inlet Pressure**
  3750 psig (420 bar) – brass
  4500 psig (505 bar) – stainless steel
- **Temperature Range**
  0 °F to 165 °F
  (-18 °C to 74 °C)
- **Ports**
  1/4" FNPT (gauges)
- **Gauges**
  2" diameter chrome-plated brass or 316 stainless steel
- **Cv**
  0.8 – 1/4" main valve
  2.0 – 3/8" main valve
- **Weight**
  6.4 lb (3 kg)

Materials

- **Body**
  Nickel-plated brass or 316 stainless steel barstock
- **Gasket**
  CTFE
- **Back-up Rings**
  Teflon®
- **Seat Main Valve**
  300 psi outlet – Teflon®
  600 psi outlet – CTFE
  1000 psi outlet – CTFE
  1500 psi outlet – CTFE
- **O-Rings**
  Viton®

Ordering Information –
Series PRS4094ABCD (Nickel-Plated Brass Body) and Series PRS4095ABCD (316L Stainless Steel Body)

A		B	C	D	E
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Inlet/Outlet Ports**	**Cv**	**Assembly/Gauges**
1: 0-300 psig	0-600 psig	0: 4000 psig	0: 3/8" FNPT	1: = Cv 0.8	0: Bare Body – Gauge Ports Open
2: 0-600 psig	0-1000 psig	1: 6000 psig*	1: 1/2" FNPT	2: = Cv 2.0	1: Standard Assembly (psi/kPa Gauges)
3: 0-1000 psig	0-3000 psig		2: 3/4" FNPT		
4: 0-1500 psig*	0-4000 psig				

* Not available with 3000 psig maximum inlet pressure.

3013 Regulators

High Purity Regulators for Oxygen Service

Dual Stage Nickel-Plated Brass Barstock Body, Four-Port Configuration, Monel Diaphragm

The 3013 Series regulators are intended for primary pressure control of oxygen, high purity gases. It is recommended for applications requiring constant delivery pressure control, regardless of supply pressure. It has been designed using only materials compatible for use In O_2 service.

Typical Applications

- Gas and liquid chromatography FID, GC, HID, PID, FPO, RD, ECD
- Ultra high purity carrier gases
- Zero, span, and calibration gases
- Petro/Chemical Industry
- Purge gases
- Laboratory analysis

Features and Benefits

- **Nickel-Plated Brass Barstock Body**
  Controlled surface integrity
- **Front Panel Mountable**
  Easy Installation
- **10 Micron Filtration**
- **Outlet Pressure Ranges 0-15 to 0-250 psig**
  Broad range of applications
- **Monel Diaphragm**
  No ignition source for higher flows
- **Low Wetted Volume**
  Minimal purge requirements
- **Convoluted Diaphragm**
  Smooth pressure transition

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter
  chrome-plated brass
- **Ports**
  1/4" FNPT
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  .05
- **Weight**
  4.8 lb (2.2 kg)

Materials

- **Body**
  Nickel-plated brass barstock
- **Bonnet**
  Nickel-plated brass barstock
- **Seat**
  First Stage – Teflon®
  Second Stage – PTFE
- **Filter**
  10 micron sintered bronze
- **Diaphragm**
  Monel
- **Internal Seals**
  Teflon®

Ordering Information — Series PRS3013ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	540
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting		
7: 0-150 psig	30"-0-200 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT		
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

3003 Series – Oxygen Single Stage Regulator

The 3003 Series is an economical oxygen regulator, for use where periodic pressure control is required. It is designed using materials approved for oxygen service.

Features and Benefits

- **Nickel Plated Brass Barstock**
  Helps ensure compatibility for oxygen service
- **Diaphragm**
  Monel reduces adiabatic heat of recompression
- **Needle Valve**
  Controls gas flow

Specifications

- **Inlet Pressure**
  3000 psig
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Cv**
  0.2
- **Body Ports**
  1/4" FNPT
- **Gauges**
  2"

Materials

- **Body**
  Nickel-plated brass barstock
- **Diaphragm**
  Monel
- **Seats and Seals**
  Neoprene/nylon
- **Bonnet**
  Chrome-plated forged brass
- **Needle Valve**
  Chrome-plated brass barstock

Ordering Information – Series PRS3003ABCD-540

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	540
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting		
7: 0-150 psig	30"-0-200 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT		
			5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option – 3003 Series	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details

3005 Regulators

Oxygen Line Regulators

3005 Series – Line Regulator

The 3005 Series is an economical line regulator. It can be used for point of use control of oxygen.

Features and Benefits

- **Nickel Plated Brass Barstock**
  Helps ensure compatibility for oxygen service
- **2" Monel Diaphragm**
  Monel reduces adiabatic heat of recompression
- **Needle Valve**
  Chrome-plated brass

Specifications

- **Inlet Pressure**
  3000 psig
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Cv**
  0.4
- **Body Ports**
  1/4" FNPT

Materials

- **Body**
  Nickel-plated brass barstock
- **Diaphragm**
  Monel
- **Seats and Seals**
  Neoprene/Nylon
- **Bonnet**
  Chrome-plated forged brass

Ordering Information – Series PRS3005ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	000: 1/4" FNPT
2: 0-50 psig	30"-0-100 psig		1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	TF2: 1/8" Tube
3: 0-100 psig	30"-0-200 psig		2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	TF4: 1/4" Tube
4: 0-250 psig	0-400 psig		3: Diaphragm Valve 1/4" Tube Fitting		TF6: 3/8" Tube
5: 0-500 psig	0-1000 psig		4: Diaphragm Valve 1/4" MNPT		TF8: 1/2" Tube
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option – 3005 Series	Description
Point of use panels	See page E•303 for details

4008 Regulators

Special Purpose Regulators for Corrosive Service

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Single Stage Anodized Aluminum Barstock Body, 316L Stainless Steel Diaphragm

The 4008 Series regulators are intended for primary pressure control of mildly corrosive high purity gases such as ammonia, hydrogen sulfide, and sulfur dioxide or for applications requiring the light weight of an aluminum body regulator.

Typical Applications

- Semi-corrosive gases and mixtures
- Gas and liquid chromatography
- High purity carrier gases
- Zero, span, and calibration gases
- High purity chamber pressurization

Features and Benefits

- **Anodized Aluminum Body**
  Cost-effective corrosion resistance
- **Front and Rear Panel Mountable**
  Versatile system configuration
- **Pressure Ranges**
  Up to 500 psig
- **High Purity Diaphragm Seal**
  1.0 x 10^{-9} cc/sec helium leak rate
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Field Adjustable Pressure Limit**
  Safeguard downstream equipment
- **Pipe Away Relief Valve**
  Safely vent exhausted gases

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F (-40 °C to 60 °C)
- **Ports**
  1/4" FNPT
- **Gauge**
  2" 316L stainless steel
- **Helium Leak Integrity**
  1 x 10^{-8} cc/sec
- **Cv**
  0.08
- **Weight**
  3.5 lb

Materials

- **Body**
  Anodized aluminum barstock
- **Bonnet**
  Chrome-plated brass barstock
- **Seat**
  PTFE Teflon®
- **Internal Seals**
  PTFE Teflon®
- **Diaphragm**
  316L stainless steel
- **Filter**
  10 micron

More Common Gases

Gas Service	Inlet Pressure
Ammonia	114 psig
Carbonyl Sulfide	160 psig
Dimethylamine	11.3 psig
Hydrogen Sulfide	252 psig
Methyl Mercaptan	15 psig
Monomethylamine	29 psig
Sulfur Dioxide	34 psig
Trimethylamine	13.3 psig
Vinyl Chloride	30 psig
Vinyl Fluoride	355 psig
Vinyl Methyl Ether	28 psig
Mixture	<3000 psig

Ordering Information – Series PRS4008ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	30"-0-30 psig	0: None	0: 1/4" FNPT Port	0: Bare Body	CGA
2: 0-50 psig	30"-0-100 psig	3: 0-4000 psig	1: 1/4" MNPT	1: Standard Assembly (psi/kPa Gauges)	
3: 0-100 psig	30"-0-200 psig	5: 0-1000 psig	2: 1/4" Tube Fitting	2: Standard Assembly (bar/psi Gauges)	
4: 0-250 psig	0-400 psig	6: 0-300 psig	3: Diaphragm Valve 1/4" Tube Fitting		
5: 0-500 psig	0-1000 psig	7: 0-400 psig	4: Diaphragm Valve 1/4" MNPT		
7: 0-150 psig	30"-0-200 psig		5: Needle Valve 1/4" MNPT		
			6: 1/8" Tube Fitting		
			7: 3/8" Tube Fitting		
			8: Diaphragm Valve 1/8" Tube Fitting		
			9: Diaphragm Valve 1/4" FNPT		

Option	Part Number	Description
Panel Mount Kit	PRS5500002T	To mount the regulator using threads on the bonnet.
Captured Vent – Standard Equipment 3000 and 4000 1/16" FNPT	PRSSG6705	For easy piping of vented gases to a safe location in the event of diaphragm failure.
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

3008 Regulators

Special Purpose Regulators – Electrically Heated

Single Stage Chrome-Plated Brass Barstock Body, 316L Stainless Steel Diaphragm, Electrically Heated for Carbon Dioxide and Nitrous Oxide

The 3008 Series regulators are designed to help prevent freeze-up problems associated with high flows of carbon dioxide and nitrous oxide.

Typical Applications

- Chemical storage blanketing
- Anaerobic chambers
- Inert gas purging
- Atomic absorption oxidizer gas
- Semiconductor reactor furnace
- Inductively coupled plasma systems
- Ph control

Features and Benefits

- **Chrome-Plated Brass Barstock Body**
  Smooth surface finish
- **Single 200 Watt Heater**
  Maintains gas flow rate up to 350 scfh
- **Two Stage Design**
  Helps prevent dry ice build-up
- **316L Stainless Steel Diaphragm**
  Unaffected by temperature or outboard diffusion
- **Low Wetted Surface Area**
  Minimal purge requirements
- **Convoluted Diaphragm**
  Smooth pressure adjustment

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Thermostat Temperature Range**
  90 °F to 125 °F, ± 8 °F
  (35 °C to 48 °C)
- **Heater**
  1 @ 200 watts
  (110 or 220 VAC)
- **Ports**
  1/4" FNPT
- **Gauges**
  2" diameter chrome-plated brass
- **Helium Leak Integrity**
  1 x 10^{-8} cc/sec
- **Cv**
  0.15
- **Weight**
  6.8 lb

Materials

- **Body**
  Chrome-plated brass barstock
- **Bonnet**
  Chrome-plated die-cast
- **Seat**
  PTFE Teflon®
- **Filter**
  10 micron
- **Diaphragm**
  316 stainless steel
- **Internal Seals**
  PTFE Teflon®

Ordering Information – Series PRS3008ABCD-CGA

Highlighted selection indicates most popular model

A		B	C	D	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge**	**Outlet Assemblies**	**Assembly/Gauges**	**Inlet Connections**
1: 0-15 psig	0-30 psig	0: None	0: 1/4" FNPT Port	0: 110 VAC Bare	CGA
2: 0-30 psig	0-60 psig	3: 0-4000 psig	1: 1/4" MNPT	1: 110 VAC (psi/kPa Gauges)	
3: 0-50 psig	0-100 psig		2: 1/4" Tube Fitting	2: 220 VAC Bar Body	
5: 0-100 psig	0-200 psig		3: Diaphragm Valve 1/4" Tube Fitting	3: 220 VAC (psi/kPa Gauges)	
			4: Diaphragm Valve 1/4" MNPT	4: 110 VAC (bar/psi Gauges)	
			5: Needle Valve 1/4" MNPT	5: 220 VAC (bar/psi Gauges	
			6: 1/8" Tube Fitting		

Option	Part Number	Description
Protocol Station	Add Letter "M" after CGA	See page E•281 for details
Protocol Switchover Station	Add Letter "C" after CGA	See page E•282 for details
Protocol Switchover Station with Alarm	Add Letter "G" after CGA	See page E•283 for details
Protocol Alarm Station	Add Letter "A" after CGA	See page E•283 for details
Deep Purge	Add Letter "D" after CGA	See page E•279 for details

170 Regulator – Low Pressure Line Regulator

The 170 Series regulators are designed to provide sensitive and accurate pressure control of non-corrosive gases at low pressure. The large rubber diaphragm delivers a steady flow at pressures below 10 psig. The 2-1/2 inch delivery pressure gauge makes outlet pressure setting easy and accurate. The pressure adjusting screw is protected by a plastic cap to prevent accidental changes of pressure setting.

Specifications

- **Maximum Inlet Pressure**
  250 psig
- **Temperature Range**
  -40 °F to 160 °F
  (-40 °C to 71 °C)
- **Maximun Flow (air):**
  PRS1701 – (360 cfm)
  PRS1702 – (550 cfm)
- **Inlet and Outlet Connections**
  1/4" MNPT

Materials

- **Body**
  Die cast zinc
- **Diaphragm**
  Buna-N
- **Seat/Seal**
  Neoprene
- **Nozzle**
  Brass
- **Gauge**
  2-1/2" chrome plated brass
- **Outlet**
  Brass needle valve

Ordering Information

Part Number	Delivery Pressure Ranges	Delivery Pressure Gauge
PRS1701-CGA	0.5-8 psig	0-10 psig
PRS1702-CGA	5-10 psig	0-15 psig

3028 Regulator – Economy Corrosive Regulator

The 3028 Series is a compact regulator for use with most corrosive gases sold in lecture bottles.

Typical Applications

- For use with delivery pressures requiring 1-6 psig

Specifications

- **Maximum Inlet Pressure**
  3000 psig
- **Temperature Range**
  30 °F to 120 °F
  (-1 °C to 49 °C)
- **Gauges**
  1-1/2" and 1-1/8" diameter stainless steel
- **Ports**
  1/4" FNPT
- **Maximum Flow Rate**
  @ 2000 psi N_2
  Model 3028-1: 500 sccm
  Model 3028-2: 90 scfh

Materials

- **Body**
  Polyvinyl Chloride
- **Seat/Seals**
  Kel F/Teflon®
- **Bonnet**
  Polyvinyl Chloride
- **Diaphragm**
  Teflon®

Ordering Information

Model Number	Delivery Pressure Range	Delivery Pressure Gauge
PRS3028-1	0-18" water column	None
PRS3028-2	0-6 psig	0-15 psig

4448 Regulators

Vaporizing Regulator

4448 Series Vaporizing Regulator

The 4448 Series regulators are designed for heat and vaporized media before and after pressure reduction. The 4448 Series is classified to meet Class 1, Groups B, C, and D code requirements.

Typical Applications

- Hydrocarbon Sampling
- Fluid fractionalization
- Pre-heat process fluids

Features and Benefits

- **Multi-turn adjustment**
  Allows high resolution temperature
- **Durability**
  Handles temperatures well
- **Two Standard Models Available**
  Electrically heated and steam
- **Stainless Steel Construction**
  High corrosion resistance

Specifications

- **Maximum Inlet Pressure**
  3500 psig
- **Outlet Pressure Ranges**
  0-25, 0-50, 0-100, 0-250, 0-500 psig
- **Operating Steam Pressure**
  200 psig
- **Operating Temperatures**
  Series 4448S – Steam
  maximum at 400 °F (204 °C)
  Series 4448E – Electrical
  150W; up to 450 °F (232 °C)
  50W; up to 350 °F (177 °C)
- **Media Operating Temperature***
  -15 °F to 450 °F
  (-26 °C to 232 °C)
- **Ambient Operating Temperature Range**
  -40 °F to 450 °F
  (-40 °C to 232 °C)
- **Cv**
  .06
- **Electric Heating Unit**
  150W (120 or 240 VAC with thermostat (optional 50W with thermostat, CSA approved)

* **Warning:** Some media may not be safe at high temperatures. For extended temperature applications, please contact factory.

Materials

- **Body**
  316 stainless steel
  Monel® is available upon request
- **Seat**
  Vespel®
- **Diaphragm**
  Elgiloy®
- **Spring**
  Elgiloy®
- **Wetted Parts**
  316 stainless steel

Ordering Information – Series PRS4448ABC

A	B	C
Model	**Outlet Pressure**	**Heating Method**
PRS4448	1: 0-25 psig 2: 0-50 psig 3: 0-100 psig 4: 0-250 psig 5: 0-500 psig	1: Steam 2: Electric 120 (VAC) 3: Electric 240 (VAC)

3000 Regulators

Flowmeter and Regulator Combinations

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Single and Dual Stage, Stainless Steel and Brass Barstock Regulator Flowmeter Combinations

The 3000 Series regulators are intended for primary pressure and flow control. The regulator flowmeter combination is a hybrid of the 3032 and 3022 series for stainless steel and the 3012 and 3002 series for brass.

Features and Benefits

- **Barstock Body**
  Controlled surface integrity
- **Front Panel Mountable**
  Easy installation
- **Pressure Ranges 0-100**
  Broad range of applications
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Low Wetted Volume**
  Minimal purge requirements
- **Pipe Away Relief Valve**
  Safely vent exhausted gases

Specifications – Regulator

For complete regulator specifications please see:

PRS3032 (page E•253)
PRS3022 (page E•254)
PRS3012 (page E•250)
PRS3002 (page E•251)

Other ranges and configurations are available.

Specifications – Flowmeter

- **Scale**
  Length: 65 mm
  Type: Fused on metering tube with contrasting yellow background
  Graduations: 0-65 mm with calibration data
- **Capacities**
  Refer to Tube Selection Table (page E•311)
- **Maximum Operating Pressure and Temperature Ratings**
  200 psig at temperatures up to 165 °F (74 °C)
- **Performance**
  Acuracy: ± 10% full scale.
  Accuracy specified for 100% to 10% of scale reading (10 to 1 rangeability)
  Repeatability: = 0.5% of full scale reading
- **Connections**
  1/8" female NPT threaded adapters with locknuts for front panel mounting
- **Approximate Weight**
  5.75 lb (2.6 kg)

Materials

- **Metering Tube**
  Borosilicate glass
- **Floats**
  Glass or 316 stainless steel
- **Float Stops**
  Teflon
- **Shields**
  Window: Clear polycarbonate
  Back: Opaque white polycarbonate
- **Tube Packing and O-rings**
  Viton® (optional materials available
- **Structural Members**
  Side plates:
  Black anodized aluminum
  End Fittings: Black anodized aluminum or 316 stainless steel
- **Structural Members**
  Metering Valve: Black anodized aluminum (standard cartridge valve only), brass/nickel-plated brass (high resolution control valve only) or 316 stainless steel

Ordering Information

Two Stage Stainless Steel

Product Code	Flow Range (Air)
PRS3032-FL0-CGA	4.5-45 sccm
PRS3032-FL1-CGA	7.8-78 sccm
PRS3032-FL2-CGA	44.5-445 sccm
PRS3032-FL3-CGA	94.8-948 sccm
PRS3032-FL4-CGA	0.22-2.19 slpm
PRS3032-FL5-CGA	0.44-4.40 slpm
PRS3032-FL6-CGA	0.85-8.49 slpm
PRS3032-FL7-CGA	1.2-11.9 slpm
PRS3032-FL8-CGA	2.0-20 slpm
PRS3032-FL9-CGA	4.3-43.4 slpm

Single Stage Stainless Steel

Product Code	Flow Range (Air)
PRS3022-FL0-CGA	4.5-45 sccm
PRS3022-FL1-CGA	7.8-78 sccm
PRS3022-FL2-CGA	44.5-445 sccm
PRS3022-FL3-CGA	94.8-948 sccm
PRS3022-FL4-CGA	0.22-2.19 slpm
PRS3022-FL5-CGA	0.44-4.40 slpm
PRS3022-FL6-CGA	0.85-8.49 slpm
PRS3022-FL7-CGA	1.2-11.9 slpm
PRS3022-FL8-CGA	2.0-20 slpm
PRS3022-FL9-CGA	4.3-43.4 slpm

Two Stage Brass

Product Code	Flow Range (Air)
PRS3012-FL0-CGA	4.5-45 sccm
PRS3012-FL1-CGA	7.8-78 sccm
PRS3012-FL2-CGA	44.5-445 sccm
PRS3012-FL3-CGA	94.8-948 sccm
PRS3012-FL4-CGA	0.22-2.19 slpm
PRS3012-FL5-CGA	0.44-4.40 slpm
PRS3012-FL6-CGA	0.85-8.49 slpm
PRS3012-FL7-CGA	1.2-11.9 slpm
PRS3012-FL8-CGA	2.0-20 slpm
PRS3012-FL9-CGA	4.3-43.4 slpm

Single Stage Brass

Product Code	Flow Range (Air)
PRS3002-FL0-CGA	4.5-45 sccm
PRS3002-FL1-CGA	7.8-78 sccm
PRS3002-FL2-CGA	44.5-445 sccm
PRS3002-FL3-CGA	94.8-948 sccm
PRS3002-FL4-CGA	0.22-2.19 slpm
PRS3002-FL5-CGA	0.44-4.40 slpm
PRS3002-FL6-CGA	0.85-8.49 slpm
PRS3002-FL7-CGA	1.2-11.9 slpm
PRS3002-FL8-CGA	2.0-20 slpm
PRS3002-FL9-CGA	4.3-43.4 slpm

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301 and 302 Regulators

High Purity Two Stage Regulator for Corrosive and Non-Corrosive Service

Piston-Sensed High Purity Low Flow Regulators
Nickel-Plated Brass Body (301 Series)
Aluminum Body Anodized (302 Series)

Typical Applications

Can be used in applications where precise pressure control is required for low flows. This regulator can also be used for transportable cylinders.

Features and Benefits

- **Compact and Light Weight**
  Can be used in a wide variety of applications
- **Available in Nickel or Aluminum**
  Wide variety of gas services
- **Low Internal Volume**
  Helps minimize gas consumption
- **Outlet Pressure Ranges**
  Three ranges 1-100 psig
- **Economical Two Stage Design**
  Long proven service life
- **316 Stainless Steel Diaphragm**
  Diffusion resistant

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Ports**
  1/8" NPTF
- **Gauges**
  Nickel-plated –
  1-1/2" chrome-plated steel
  Aluminum –
  1-1/2" 316 stainless steel

Materials

- **Body**
  Brass –
  Nickel-plated barstock
  Aluminum –
  Anodized
- **Diaphragm**
  316 stainless steel
- **Piston**
  303 stainless steel
- **Seats/Seals**
  Viton®/Teflon®

Ordering Information – Series PRS301-ABC-CGA (Nickel) and Series PRS302-ABC-CGA (Aluminum)

A		B	C	CGA
Outlet Pressure	**Outlet Gauge**	**Inlet Gauge***	**Outlet Assemblies**	**Inlet Connections**
1: 0-10 psig 2: 0-50 psig 3: 0-100 psig	0-30 psig 0-100 psig 0-200 psig	1: 0-3000 psig	0: 1/8" FNPT 1: Needle Valve 1/8" MNPT 2: Compression Fitting, 1/8" MNPT x 1/8" Compression 3: Compression Fitting, 1/8" MNPT x 1/4" Compression	CGA, DIN, BS and others available

7000 Regulators

Special Purpose Regulators for Semiconductor Process Gases

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Single Stage Electropolished 316L Stainless Steel Barstock Body – Two, Three and Four Port Configurations VCR Connections

The 7002 and 7003 Series regulators are intended for secondary pressure control of the highest purity gases or as point of use pressure control in semiconductor process gas distribution systems. The 7004 Series regulators are intended for primary pressure control of semiconductor process gases as well as applications requiring constant delivery pressure control, regardless of supply pressure variations.

Typical Applications

- Semiconductor process gases
- Gas and liquid chromatography
- Ultra high purity carrier gases
- Zero, span, and calibration gases

Features and Benefits of the 702, 703 and 704 Series Regulators

- **Butt-Welded VCR Connections**
  Highest leak integrity available
- **316 Stainless Steel Barstock Body**
  Enhanced corrosion resistance
- **Front and Rear Panel Mountable**
  Versatile system configuration
- **Pressure Ranges 0-15 to 0-500 psig**
  Broad range of applications
- **3000 psig Inlet Pressure Rating**
  Safe use with high pressure cylinders
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **316L Stainless Steel Diaphragm**
  No inboard diffusion
- **Orientable Captured Vent Capable**
  Safe and easy installation
- **Field Adjustable Pressure Limit**
  Safeguard downstream equipment

Specifications

- **Operating Pressure**
  Vacuum to 500 psig (241 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Ports**
  1/4" VCR
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  0.06

Materials

- **Body**
  316L stainless steel
- **Bonnet**
  Chrome-plated brass barstock
- **Poppet**
  Stainless steel
- **Nozzle**
  316L stainless steel
- **Spring**
  Elgiloy®
- **Seat**
  KEL-F® 81

Ordering Information – Series PRS7002-ABCD, PRS7003-ABCD and PRS7004-ABCD

Highlighted selection indicates most popular model

	A		B	C	D
Series 7002	**Outlet Pressure**	**Outlet Gauge**	**Inlet Gauge**	**Port Configuration**	**Assembly/Gauges**
	1: 0-15 psig 2: 0-50 psig 3: 0-100 psig	0: None	0: None	0: 1/4" Tube Stub 1: FVCR x MVCR 2: MVCR x MVCR 3: MVCR x FVCR 4: FVCR x FVCR 5: IFS x IFS (IFS = Internal Face Seal)	0: Bare Body 1: Standard Assembly

	A		B	C	D
Series 7003	**Outlet Pressure**	**Outlet Gauge**	**Inlet Gauge**	**Port Configuration**	**Assembly/Gauges**
	1: 0-15 psig 2: 0-50 psig 3: 0-100 psig	30"-0-30 psig 30"-0-100 psig 30"-0-200 psig	0: None	0: 1/4" Tube Stub 1: FVCR x MVCR 2: MVCR x MVCR 3: MVCR x FVCR 4: FVCR x FVCR 5: IFS x IFS	0: Bare Body (Welded Gauge Ports) 1: Standard Assembly Welded Gauge Ports) 2: Bare Body (IFS Guage Ports) 3: Standard Assembly (IFS Gauge Ports)

	A		B	C	D
Series 7004	**Outlet Pressure**	**Outlet Gauge**	**Inlet Gauge**	**Port Configuration**	**Assembly/Gauges**
	1: 0-15 psig 2: 0-50 psig 3: 0-100 psig Other outlet pressure ranges available upon request.	30"-0-30 psig 30"-0-100 psig 30"-0-200 psig	0: None 3: 0-4000 psig 6: 0-1000 psig	0: 1/4" Tube Stub 1: FVCR x MVCR 2: MVCR x MVCR 3: MVCR x FVCR	0: Bare Body (Welded Gauge Ports) 1: Standard Assembly Welded Gauge Ports) 2: Bare Body (IFS Guage Ports) 3: Standard Assembly (IFS Gauge Ports)

5002 Purges

Purge Assemblies

5002 Series Purge Assemblies Deep Purge, Tee Purge, Straight Purge

The 5002 Series purges are designed for use with high purity gases to insure system integrity upon breakdown of components or during gas source changes. Most commonly, these purge assemblies are used with pressure control devices as an integral option or can be used within gas delivery systems to isolate pressure or flow control equipment.

The 5002 Series purges are offered in brass and stainless steel. Brass and stainless steel purges are offered only with diaphragm valves. Optional testing can be provided to certify these purge assemblies are helium leak-tight for the most demanding services. These devices are intended for use with chemicals that are compatible with the listed materials.

Deep Purge

Tee Purge

Straight Purge

Specifications

- **Maximum Pressure**
  3000 psig (20,700 kPa)
- **Weight**
  Deep purge: 3.0 lb (1.4 kg)
  Tee purge: 2.5 lb (1.1 kg)
  Straight purge: 1.2 lb (0.6 kg)
- **Seat/Seals**
  KEL-F®/Teflon®
- **Body**
  Brass purge: Brass barstock
  SS purge: 316 stainless steel
- **Diaphragms (purge valves)**
  Brass purge: Elgiloy®
  SS purge: BeCu and stainless steel

Ordering Information – Series PRS5002

Part Number	Description
PRS50023007-CGA	Deep Purge, Brass
PRS50023009-CGA	Deep Purge, Stainless Steel
PRS50022003-CGA	Tee Purge, Brass
PRS50022005-CGA	Tee Purge, Stainless Steel
PRS50021002-CGA	Straight Purge, Brass
PRS50021005-CGA	Straight Purge, Stainless Steel

Cylinder Alarm Monitor

The low cylinder alarm monitor is used to monitor the contents of non-corrosive, non-flammable, non-liquefied gas cylinders where pressure is proportional to the remaining contents. It has been designed to mount directly to a cylinder. A built in alarm will sound when the field adjustable pressure is set. Unit operates on a 9 volt battery, and has a battery indicator. **Only available in CGA 580.**

Specifications

- **Temperature Range**
  0 to 125 °F
- **Wetted Parts**
  Brass
- **Power**
  9 volt battery
- **Adjustable Range**
  200 to 2500 psig

Ordering Information – Series PRS5002

Part Number	Description
PRS00100001-580	Battery Alarm

400, 402 and 403 Series Flow Control Valves

These precision valves are used to provide manual flow control for applications not requiring a pressure regulator.

Caution: Closed systems could reach full cylinder pressure with the use of these devices.

Ordering Information

Series	Part Number	Outlet Conection	Material	Maximum Pressure
400	PRS4001-CGA	Hose End	Brass	0-3000 psig
	PRS4002-CGA	1/4" Tube	Brass	0-3000 psig
	PRS4003-CGA	1/4" FNPT	Brass	0-3000 psig
402	PRS4021-CGA	Hose End	316 SS	0-3000 psig
	PRS4022-CGA	1/4" Tube	316 SS	0-3000 psig
	PRS4023-CGA	1/4" FNPT	316 SS	0-3000 psig
403	PRS4031-CGA	Hose End	Monel®	0-3000 psig
	PRS4032-CGA	1/4" Tube	Monel®	0-3000 psig

401 Series Flow Control Valves

The 401 Series manual control valves are similar to the 400, 402 and 403 Series but with the addition of a 0-3000 psig gauge for monitoring cylinder pressure.

Caution: Closed systems could reach full cylinder pressure with the use of these devices.

Ordering Information

Series	Part Number Conection	Outlet	Material Pressure	Maximum
401	PRS4011-CGA	Hose End	Brass	0-3000 psig
	PRS4012-CGA	1/4" Tube	Brass	0-3000 psig
	PRS4013-CGA	1/4" FNPT	Brass	0-3000 psig

Gas Delivery Systems

Protocol Station

5029 Protocol Station

The 5029 Series Protocol Station is a regulator option designed for the convenient wall mounting of any *ProSpec*™ regulator. Wall mounting of a regulator provides ease of use, helps prevent regulator damage and helps to improve safety. The 5029 Series Protocol Station is available in brass or 316 stainless steel construction as specified by the regulator series. This option comes complete with a 3 foot long flexible all stainless steel pigtail with armor casing. The CGA connection on the pigtail has an integral check valve in the gland to help prevent internal contamination during cylinder changeout. Should purging be desired, the gas block comes with a plugged port which can be removed and replaced with a diaphragm valve.

Shown with optional PRS4022 Regulator (see page E•248)

Features and Benefits

- **Plugged Port in Gas Block**
  Facilitates purging
- **Integral Check Valve**
  No internal contamination during cylinder changeout
- **Bracket Mounts**
  Attaches conveniently to most surfaces

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Weight (For Single Stage Regulator)**
  3.1 lb (1.4 kg) less regulator
- **Weight (For Dual Stage Regulator)**
  3.5 lb (1.6 kg) less regulator

Materials

- **Gas Block**
  316L stainless steel
  Chrome plated brass for O_2 service
- **Pigtail – standard**
  316L stainless steel inner core
  316L stainless steel braid (2 layers)
  304 stainless steel armor casing
- **Pigtail Oxygen Service**
  Monel inter core (wetted part)
  316L stainless steel braid
  304 Armor casing
- **Inlet Connection**
  316L stainless steel or brass CGA
- **Check Valve O-Ring**
  Viton®

Ordering Information – Series PRS5029

Part Number	Description
PRS50290105-CGA	Protocol Station with single or two stage brass or chrome plated regulators for pressures up to 3000 psig.
PRS50290106-CGA	Protocol Station with single or two stage stainless steel regulators for pressures up to 3000 psig.
PRS50290125-CGA	Protocol Station with single or two stage brass or chrome plated regulators for pressures up to 4500 psig.
PRS50290126-CGA	Protocol Station with single or two stage stainless steel regulators for pressures up to 4500 psig.
PRS50290127-CGA	Protocol Station with single or two stage stainless steel regulators for pressures up to 6000 psig.
PRS50290029-CGA	Pigtail, 316L stainless steel 1/4" MPT x 316 stainless steel CGA, 36" long replacement pigtails.
PRS50290031-CGA	Pigtail, 316L stainless steel 1/4" MPT x brass CGA, 36" long replacement pigtails.

Option	Part Number	Description
Protocol Station	Add letter "M" after regulator part number	For example, to order a PRS40221331-580 regulator with a wall mount Protocol Station, the part number would be PRS40221331-580M

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5029 Protocol Switchover Station

The 5029 Series Protocol Switchover Station combines all of the safety and convenience features of a standard Protocol Station with the added efficiency of having a reserve cylinder connected to the system. The Protocol Switchover Station valving allows manual switching between a primary cylinder and reserve cylinder. Isolation of the depleted cylinder allows safe changeout without back flow of gas through the pigtail.

Protocol Switchover Stations are available in brass or 316 stainless steel with a variety of pressure ranges (3,000 psig, 4,500 psig and 6,000 psig). The system comes complete with a Protocol Station, two 3-foot tall stainless steel pigtails with armor casing, two 1/4 turn diaphragm valves (3,000 psig) or needle (4,500 or 6,000 psig). Alarms are also available for the Protocol Switchover Station.

Features and Benefits

- **Plugged Port in Gas Block**
  Facilitates purging
- **Pressure Switch Gauge**
  Provides visual warning of cylinder depletion (optional)
- **Remote Alarm (Optional)**
  Provides audible and visual warning of cylinder depletion
- **Integral Check Valve**
  No internal contamination during cylinder changeouts
- **Mountable to Any Suitable Surface**
  Easy installation
- **Gas Block**
  Helps maintains gas purity
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **Low Wetted Surface Area**
  Minimal purge requirements
- **316L Stainless Steel Diaphragm**
  No inboard diffusion

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  4500 psig (300 bar) optional
  6000 psig (380 bar) optional
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Weight**
  3.5 lb (1.6 kg) less regulator

Materials

- **Gas Block**
  316L stainless steel barstock
  Chrome plated brass for oxygen service
- **Check Valve O-Ring**
  Viton®
- **Bracket**
  316L stainless steel
- **Inlet Connection**
  Brass or 316L stainless steel CGA
- **Flexible Pigtails**
  316 stainless steel barstock Innercore – Monel® for oxygen service

Ordering Information – Series PRS5029

Part Number	Description
PRS50290155-CGA	Protocol Switchover for chrome-plated or brass regulators maximum inlet 3,000 psig (4,000 psig)
PRS50290156-CGA	Protocol Switchover for 316L stainless steel regulators maximum inlet 3,000 psig (4,000 psig)
PRS50290158-CGA	Protocol Switchover for chrome-plated or brass regulators maximum inlet 4,500 psig (6,000 psig)
PRS50290159-CGA	Protocol Switchover for 316L stainless steel regulators maximum inlet 4,500 psig (6,000 psig)
PRS50290160-CGA	Protocol Switchover for 316L stainless steel regulators maximum inlet 6,000 psig (10,000 psig)

Option	Part Number	Description
Protocol Switchover Station with Regulator	Add letter “C” after regulator part number	For example, to order a PRS40221331-580 regulator with a Protocol Switchover Station, the part number would be PRS40221331-580C.
Protocol Switchover Station with Alarm and Regulator	Add letter “G” after regulator part number	For example, to order a PRS40221331-580 regulator with a Protocol Switchover Station with alarm, the part number would be PRS40221331-580G.

Gas Delivery Systems

Protocol Alarm Station

5029 Protocol Alarm Station

The 5029 Series Protocol Alarm Station combines the safety and features of a standard Protocol Station with the added security of a remote alarm system. The Protocol Alarm Station will provide an audio/visual warning when a cylinder is nearly depleted. The alarm set point is easily field adjustable to provide the level of security and notification required. A convenient side port allows the addition of a diaphragm valve for purging when changing cylinders.

The Protocol Alarm Station systems are available in 316 stainless steel with a variety of gauge ranges (600 psig, 4,000 psig, 6,000 psig, and 10,000 psig). The system comes complete with a Protocol Station, a 3-foot all stainless steel pigtail with armor casing, pressure switch gauge and remote alarm/power supply in either 110 vac or 220 vac. It may be ordered separately or attached to any high purity regulator.

Shown with optional PRS4022 Regulator (see page E•248)

Features and Benefits

- **Plugged Port in Gas Block**
  Facilitates purging
- **Pressure Switch Gauge**
  Provides visual warning of cylinder depletion
- **Remote Alarm**
  Provides audible and visual warning of cylinder depletion
- **Integral Check Valve**
  No internal contamination during cylinder changeout
- **Mountable to Any Surface**
  Easy installation
- **Gas Block**
  Helps maintain gas purity
- **Metal-to-Metal Diaphragm Seal**
  Limits possibility of gas contamination
- **Low Wetted Surface Area**
  Minimal purge requirements

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  4500 psig (300 bar) optional
  6000 psig (380 bar) optional
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Weight**
  3.5 lb (1.6 kg) less regulator

Materials

- **Gas Block**
  316L stainless steel barstock
  Chrome plated brass oxygen service
- **Check Valve O-Ring**
  Viton®
- **Bracket**
  304 stainless steel
- **Inlet Connection**
  1/4" brass or 316L stainless steel
- **Flexible Pigtails**
  316 stainless steel barstock
  Innercore – Monel® for oxygen service

Ordering Information – Series PRS5029

Part Number	Description
PRS50291095-CGA	Protocol Alarm* maximum inlet 400 psig (600 psig gauge)
PRS50291101-CGA	Protocol Alarm* for brass regulators maximum inlet 3,000 psig (4,000 psig)
PRS50291103-CGA	Protocol Alarm* for stainless steel regulators maximum inlet 3,000 psig
PRS50291121-CGA	Protocol Alarm* for stainless steel regulators maximum inlet 4,500 psig (6,000 psig)
PRS50291133-CGA	Protocol Alarm* 6,000 psig (10,000 psig)

* Intrinsic Safety Barriers required for flammable service

Option	Part Number	Description
Protocol Alarm Station with Regulator	Add letter "A" after regulator part number	For example, to order a PRS40221331-580 regulator with a Protocol Alarm Station, the part number would be PRS40221331-580A.

Gas Delivery Systems

Critical Purity Automatic Switchovers for Non-Corrosive and Corrosive Service

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5022 and 5023 Critical Purity Switchover

The 5022 (Brass) and 5023 (316 Stainless Steel) Series high purity automatic switchover systems are designed to provide continuous supply of high purity gases to the laboratory, process or instrument. The system automatically changes cylinder or bank priority from primary to reserve with no fluctuation in line pressure to provide a continuous, uninterrupted supply of gas to the process, laboratory or instrument. Each system may be ordered with internal pressure switches and a power supply/remote alarm to provide both local and remote indication of bank status. For use with flammable gases or in hazardous locations (class 1, division 1, groups A, B, C, or D) optional intrinsic safety barriers are available. A second option is a telephone dialer which will signal when a bank is empty. For handling toxic or poisonous gases, the 5023 Series is available with optional captured venting.

Features and Benefits

- **Integral Line Regulator**
  Stable line pressure during cylinder changeout
- **Metal-to-Metal Diaphragm Seal**
  No possibility of gas contamination
- **User Friendly Priority Valve**
  One lever switches cylinder priority
- **Check Valves in Inlet Gland**
  Designed to prevent contamination and back flow
- **Intrinsic Safety**
  Safe use with flammable gases

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 165 °F
- **Gauges**
  Brass, bronze and stainless steel
- **Maximum Flow (Nitrogen)**
  1200 scfh
- **Relief Valve**
  3/8" pipe away
- **Inlet Connection**
  1/4" FPT
- **Outlet Connection**
  3/8" NPTF
- **Helium Leak Integrity**
  2 x 10^{-8} scc/sec
- **Weight**
  40 lb (18 kg)
- **Dimensions**
  12"W x 15.75"H x 9"D (30.5 x 40 x 23 cm)

Materials

- **Line Regulator**
  5022 Series: brass barstock
  5023 Series: 316 SS barstock
- **Diaphragms**
  316L stainless steel
- **Seats**
  PTFE and CTFE
- **Tubing**
  316 stainless steel
- **Pigtails**
  316L stainless steel, armor jacketed
- **Check Valves**
  5022 Series – Brass with Viton® seals
  5023 Series – 316 stainless steel with Viton® seals
- **Internal Seals**
  PTFE
- **Pressure Switch**
  5022 Series – Brass
  5023 Series – 316 stainless steel
- **Enclosure**
  Acrylic powder-coated steel Nema 4x

Ordering Information – Series PRS5022ABCD-CGA (Brass) and Series PRS5023ABCD-CGA (316 Stainless Steel)

A	B	C	D	CGA
Outlet Pressure	**Inlet Connections**	**Cylinder/Side**	**Assembly**	**Pigtail**
2: 0-50 psig 3: 0-100 psig 5: 0-350 psig 7: 0-150 psig	0: 1/4" FNPT for Non-Toxic Gases 1: Manifolds for Non-Toxic Gases (36" flexible pigtails at each station) 3: Diaphragm Valves for Non-Toxic Gases* (Two 36" flexible pigtails) 4: Manifolds for Non-Toxic Gases (24" flexible pigtails at each station) 5: SS Manifolds for Toxic Gases** (36" flexible pigtails at each station) 7: SS Manifolds for Toxic Gases** (24" flexible pigtails at each station) 8: Diaphragm Valves for Toxic Gases** (Two 36" flexible pigtails) 9: Diaphragm Valves for Non-Toxic Gases* (Two 72" flexible pigtails)	0: No Inlet Connection 1: One Cylinder 2: Two Cylinders 3: Three Cylinders 4: Four Cylinders 5: Five Cylinders 6: Six Cylinders 7: Seven Cylinders 8: Eight Cylinders 9: Nine Cylinders	1: Without Pressure Switches 2: With Remote Alarm (110 VAC) 3: With Remote Alarm (220 VAC) 4: Without Remote Alarm* 5: With Remote Alarm (110 VAC) and Intrinsic Safety Barriers 6: With Remote Alarm (220 VAC) and Intrinsic Safety Barriers 7: Without Remote Alarm With Intrinsic Safety Barriers*	Please Specify inlet CGA connection (if applicable)

* One cylinder/side only
** Includes captured vent

* Requires system with alarm
Note: All assemblies (except number 1) include pressure switches

5026 and 5027 Systems

Critical Purity Automatic Switchovers for Non-Corrosive and Corrosive Service

Critical Purity Switchover

The 5026 (Brass) and 5027 (316 Stainless Steel) Series high purity automatic switchover systems are designed to provide continuous supply of high purity gases to the laboratory, process or instrument. Due to pressure differential considerations, a line regulator is recommended downstream of the system. The 5026/5027 Series may be ordered with the line regulator installed at the outlet or the line regulator may be ordered separately for downstream point of use installation. Typically the 5026/5027 Series are used with one cylinder per side. To connect more than one cylinder per side, please order manifold headers separately (see page E•296). The standard models come with flexible, all stainless steel (Monel® lined for Oxygen service) pigtails with armor casing. The CGA connection on each pigtail has a check valve in the gland to prevent contamination and minimize purging requirements.

5026 Series standard assembly (PRS50264131-580)

Features and Benefits

- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of gas contamination
- **User Friendly Priority Valve**
  One knob switches cylinder priority
- **Check Valves in Inlet Gland**
  Designed to prevent contamination and back flow
- **Flexible Pigtails**
  3' – 316 stainless steel with armor casing Monel® for oxygen service

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  4500 psig (300 bar) optional
- **Temperature Range**
  -40 °F to 140 °F
  (-28 °C to 60 °C)
- **Gauges**
  2" diameter
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec
- **Cv**
  .06
- **Weight**
  8.25 lb (3.71 kg)

Materials

- **Bodies**
  5026 Series – brass barstock
  5027 Series – 316 stainless steel barstock
- **Diaphragms**
  316 stainless steel
- **Seat**
  PTFE
- **Filter**
  10 micron
- **Internal Seals**
  PTFE

5026 Series shown with (Z) isolation and purge valves (PRS502631Z71-580)

Ordering Information –
Series PRS5026ABCD-CGA (Chrome-Plated Brass Body) and Series PRS5027ABCD-CGA (316L Stainless Steel Body)

A Switching Pressure	B Inlet Connections	C Line Regulator	D Assembly/Gauges	CGA Pigtail
(Priority Right/Left) 2: 70 psig/50 psig 3: 100 psig/75 psig 4: 200 psig/170 psig 5: 470 psig/430 psig 7: 150 psig/130 psig 8. 300 psig/270 psig	0: 1/4" FNPT Ports 1: Flexible SS Pigtails (36")* 2: Manifold Connectors* 3: Flexible SS Pigtails (24")* 4: Diaphragm Valves with 1/4" FNPT Port 5: Diaphragm Valves with Pigtails (36")* 6: Diaphragm Valves with Manifold Connectors (See page E•296 for headers) 7: Diaphragm valves with Pigtails (24")* 8: Flexible Teflon-lined Pigtails (36")** (4500 psig maximum inlet pressure) 9: 1/4" FNPT Ports (4500 psig maximum inlet pressure) Z: Purge and Isolation Valves	0: None 1: 0-15 psig 2: 0-50 psig 3: 1-100 psig 4: 0-250 psig 7: 0-150 psig	1: Standard Assembly (psi/kPa Gauges) 2: Standard Assembly (psi/Bar Gauges) 3: Pressure Switches and Remote Alarm 4: 600 psi Pressure Switches and Remote Alarm	Please specify inlet CGA connection (if applicable)

* Pigtails for oxygen service have Monel® inner core.
** 4500 psig maximum inlet pressure.

5028 Gas Delivery System

High Purity Automatic Changeover for Non-Corrosive and Corrosive Service

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High Purity Automatic Changeover System

The 5028B (Brass) and 5028S (316 Stainless Steel) Series high purity automatic changeover systems are designed to provide continuous supply of high purity gases to the laboratory, process or instrument. Due to pressure differential considerations, a line regulator comes standard. Typically the 5028B/5028S Series are used with one cylinder per side. To connect more than one cylinder per side, please order manifold headers separately (see page E•296). The standard models come with flexible, all stainless steel (Monel® lined for oxygen service) pigtails with armor casing. The CGA connection on each pigtail has a check valve in the gland to prevent contamination and minimize purging requirements.

Features and Benefits

- **High Purity Diffusion Resistant Regulators**
  Minimize the diffusion of air, no possibility of gas contamination
- **User Friendly Priority Valve**
  One knob switches cylinder priority
- **Flexible Pigtails**
  3' – 316 stainless steel with armor casing Monel® for oxygen service
- **Check Valves in Inlet Gland**
  Designed to prevent contamination and back flow
- **Modular Construction**
  Allows for easy installation, modular design for a smaller foot print

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  Gauge: 0-4000
  Ports: 1/4" FNPT
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass or stainless steel
- **Cv**
  0.06
- **Helium Leak Integrity**
  1 x 10^{-7} scc/sec
- **Weight**
  7.75 lb (3.71 kg)
- **Line Regulator**
  Brass: PRS3004
  (see page E•252)
  Stainless steel: PRS3024
  (see page E•255)

Materials

- **Bodies**
  5028B Series: Chrome-plated brass barstock
  5028S Series: 316 stainless steel barstock
- **Diaphragms/Spring**
  316 stainless steel
- **Valve Seat**
  Teflon®
- **Filter**
  10 micron
- **Friction Sleeve**
  Outer – Teflon®
  Inner – Teflon®

Ordering Information — Series PRS5028-ABC-CGA (Brass or 316L Stainless Steel)

A	B		C	CGA
Material of Construction	**Line Regulator Outlet**	**Outlet Gauge**	**Assembly**	**Pigtail**
B: Brass S: Stainless Steel	0: 0-25 psig 1: 0-50 psig 2: 0-100 psig 3: 0-150 psig	30"-0-60 psig 30"-0-100 psig 30"-0-200 psig 30"-0-200 psig	0: Standard Assembly 1: With Alarm	Please specify CGA

Option	Page Number
Tube Fittings	E•380 - E•381
Header Manifolds	E•296

5031 Gas Delivery System

High Flow Automatic Changeover for Non-Corrosive and Corrosive Service

High Flow/High Purity Automatic Changeover System

The 5032B (Brass) and 5031S (316 Stainless Steel) Series high flow/high purity automatic changeover systems are designed to provide continuous supply of high purity gases to the laboratory, process or instrument. The Series 5032 incorporates two regulators set at different delivery pressures. Down stream line regulators are recommended to help eliminate supply pressure effects.

Basic Functional Description

When primary supply to the changeover (primary) is consumed, the secondary supply (reserve) feeds the downstream process. By turning the regulator handknob clockwise, the primary supply can then be replenished. When the reserve is depleted the primary will then begin to feed the process. With a counter clockwise turn of the changeover regulator handknob, the reserve side can than be replenished.

Typically the 5031B/5031S Series are used with one cylinder per side. To connect more than one cylinder per side, please order manifold headers separately (see page E•296). The standard models come with flexible, all stainless steel (Monel® lined for oxygen service) pigtails with armor casing. The CGA connection on each pigtail has a check valve in the gland to prevent contamination and minimize purging requirements.

Features and Benefits

- **High Purity Diffusion Resistant Regulators**
  Minimize the diffusion of air, no possibility of gas contamination
- **User Friendly Priority Valve**
  One knob switches cylinder priority
- **Check Valves in Inlet Gland**
  Designed to prevent contamination and back flow
- **Modular Construction**
  Allows for easy installation, modular design for a smaller foot print

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  Gauge: 0-4000
  Ports: 1/2" NPTF
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass or stainless steel
- **Outlet Pressure**
  0-400 psig
- **Helium Leak Integrity**
  1 x 10^{-7} scc/sec
- **Weight**
  17.0 lb
- **Flow**
  Up to 5500 scfh

Materials

- **Bodies**
  5032B Series: brass barstock
- **Diaphragms/Spring**
  316 stainless steel
- **Seat**
  PCTFE
- **Seal**
  Teflon®

Ordering Information – Series PRS5032-AB-CGA (Brass or 316 Stainless Steel)

A	B	C	CGA
Material of Construction	**Assembly**	**Delivery Pressure**	**Pigtail**
B Brass	0: Standard Assembly	1: 0-125	
S Stainless Steel	1: Audio/Visual Alarm	2: 0-250	CGA
		3: 0-500	

8000 Gas Delivery System

Dewar and High Pressure Cylinder Changeover System

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ProSpec™ Series 8000 Automatic Dewar and High Pressure Cylinder Changeover System

The Series 8000 Automatic Changeover System is designed to provide an uninterrupted flow of gas from two sources, when lower flow requirements are needed. When one source is in service providing the gas to process; the other source is on standby, and comes on line when the current source has depleted. The changeover to the standby source occurs automatically. Once the changeover has occurred, a gas technician replaces the depleted source, turns the changeover regulator hand knob to the next standby source.

The Series 8000 system includes a line regulator to allow adjustment of the final delivery pressure to the process. Also included are 6' stainless steel armor-jacketed flexible pigtails, with CGA check valves, cylinder isolation and vent valves. This configuration gives the operator the capability to isolate a source from the changeover panel, allowing replacement of the source without having to shut down the system.

Features and Benefits

- **Integral Line Regulator**
  Constant delivery pressure
- **6' Stainless steel pigtails**
  Easy cylinder connections
- **Preset Dual Back Pressure Regulators**
  Allows gas flow to enter the process piping
- **User Friendly Priority Valve**
  Single lever operation
- **Check Valves**
  Helps prevent backflow
- **Automatic Changeover**
  Continuous gas supply
- **Panel Mounted**
  Easy installation

Specifications

- **Maximum Inlet Pressure**
  Dewar – 400 psig
  High pressure cylinder – 3000 psig
- **Outlet pressure Range 0-100 psig**
  Maximum flow @ 80 psig outlet 25 slpm
- **Temperature Range**
  -40 °F to 148 °F
- **Gauges**
  2-1/2"

Materials

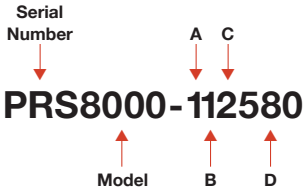
- **Bodies**
  Brass Barstock
- **Diaphragms**
  316L
- **Seats/Seals**
  PTFE

Ordering Information – Series PRS8000

Series Number	Model	A Number of Dewars	B Number of Cylinders	C Options	D CGA
PRS	8000	1: 1 2: 2 3: 3	1: 1 2: 2 3: 3 4: 4 5: 5 6: 6	1: No Alarm 2: Audio/Visual	580 320 540

Example Part Number

PRS8000-112580 = Basic changeover for one dewar and one high pressure cylinder, with alarm and CGA 580.



9000 Gas Delivery System

Dewar Changeover System

ProSpec™ Series 9000 Automatic Dewar Changeover System

The Series 9000 Automatic Dewar Changeover System is designed to provide an uninterrupted flow of gas from one of two sources. When one source is in service providing the gas to process; the other source is on standby, and comes on-line when the current source has depleted. The changeover to the standby source occurs automatically. Once the changeover has occurred, a gas technician replaces the depleted source, turns the changeover regulator hand knob to the next standby source. The Series 9000 system employs a unique Tri-Block design, which incorporates dual back pressure regulators and a line regulator. This Tri-Block assembly functions as an economizer circuit, to prevent venting of the reserve source.

The Series 9000 system includes a line regulator to allow adjustment of the final delivery pressure to the process. Also included are 6' stainless steel armor-jacketed flexible pigtails, with CGA check valves, cylinder isolation and vent valves. This configuration gives the operator the capability to isolate a source from the changeover panel, allowing replacement of the source without having to shut down the system.

Features and Benefits

- **Integral Line Regulator**
  Constant delivery pressure
- **6' Stainless steel pigtails**
  Easy cylinder connections
- **Preset Dual Back Pressure Regulators**
  Allows gas flow to enter the process piping
- **User Friendly Priority Valve**
  Single lever operation
- **Check Valves**
  Helps prevent backflow
- **Automatic Changeover**
  Continuous gas supply
- **Panel Mounted**
  Easy installation

Specifications

- **Maximum Inlet Pressure**
  400 psig
- **Outlet Pressure Range**
  0-100 psig
- **Maximum flow @ 80 psig outlet**
  25 slpm
- **Temperature Range**
  -40 °F to 148 °F
- **Gauges**
  2-1/2"

Materials

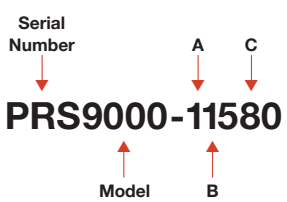
- **Bodies**
  Brass Barstock
- **Diaphragms**
  316L
- **Seats/Seals**
  PTFE

Ordering Information – Series PRS9000

Series Number	Model	A (Number of Dewars)	B (Options)	C (CGA)
PRS	9000	1: 1 x 1 2: 2 x 2 3: 3 x 3	1: No Alarm 2: Audio/Visual	580 320 540

Example Part Number

PRS9000-11580 = Basic changeover for two dewars, no alarm and CGA 580



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ProSpec™ Series 9500 Automatic Dewar Changeover System

The Series 9500 Automatic Dewar Changeover System is a fully automatic system designed to provide an uninterrupted flow of gas from two sources. When one source is in service providing the gas to process; the other source is on standby, and comes on-line when the current source has depleted. The changeover to the standby source occurs automatically. The Series 9500 system employs a unique Economizer Circuit, to prevent venting of the reserve source.

The Series 9500 system includes 6' stainless steel armor-jacketed flexible pigtails, with CGA check valves, cylinder isolation valves. This configuration gives the operator the capability to isolate a source from the changeover panel, allowing replacement of the source without having to shut down the system.

Applications – GC and LCMS, process and analytical equipment that requires 24/7/365 operation.

Features and Benefits

- **Fully automatic operation**
  No levers or knobs to change
- **Six fully programmable switchover pressures**
  Reduces product waste
- **Automatic Changeover**
  Continuous gas supply
- **Seperate control and alarm box**
  Allows for flexibility during installations
- **Wall Mounted**
  Easy installation

Specifications

- **Maximum Inlet Pressure**
  500 psig
  Delivery pressure range
  20-225 psig
- **Temperature Range**
  -20 °F to 148 °F

Materials

- **Bodies**
  Brass Barstock
- **Diaphragms**
  316L
- **Seats/Seals**
  PTFE

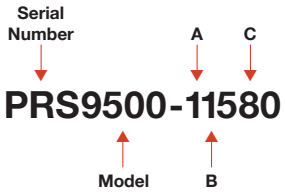
Ordering Information – Series PRS9500

Series Number	Model	A (Number of Dewars)	B (Standard)	C (CGA)
PRS	9500	1: 1 x 1	1: Audio/Visual	580
		2: 2 x 2		320
		3: 3 x 3		540

Option	Part Number
100' Cable Extension	PRSP4302112
25' Cable Extension	PRSP4302113
100' Alarm Cable Extension	PRSP4302114
25' Alarm Cable Extension	PRSP4302115
Audio/Visual Alarm Cable Extension	PRSP4302104

Example Part Number

PRS9500-11580 = Basic changeover for two dewars, (1 primary, 1 reserve) alarm and CGA 580



Gas Delivery Systems

High Flow Switchover for Non-Corrosive Service

ProSpec™ 5033 Gas Delivery Systems
High Flow/High Purity Switchover System

The 5033B and 5033S Series high flow/high purity changeover systems are designed to provide continuous supply of high purity gases to the laboratory, process or instrument. The 5033 Series incorporates two regulators set at different delivery pressures, and a primary outlet pressure regulator.

Basic Functional Description

When primary supply to the changeover (primary) is consumed, the secondary supply (reserve) feeds the downstream process. By turning the regulator lever counter clockwise, the primary supply can then be replenished. When the reserve is depleted the primary will then begin to feed the process. With a counter clockwise turn of the changeover regulator handknob, the reserve side can than be replenished.

Typically the 5033 Series are used with liquid dewars. The standard models come with flexible, all stainless steel (Monel® lined for oxygen service) pigtails with armor casing. The CGA connection on each pigtail has a check valve in the gland to help prevent contamination and minimize purging requirements.

Features and Benefits

- **High Purity Diffusion Resistant Regulators**
  Minimize the diffusion of air, no possibility of gas contamination
- **User Friendly Priority Lever**
  One lever switches cylinder priority
- **Check Valves in Inlet CGA Gland**
  Designed to prevent contamination and back flow
- **Modular Construction**
  Allows for easy installation, modular design for a smaller foot print

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
  Gauge: 0-4000
  Ports: 1/2" NPTF
- **Temperature Range**
  -40 °F to 165 °F
  (-40 °C to 74 °C)
- **Gauges**
  2" diameter brass
- **Outlet Pressure Ranges**
  0-125 psig
  0-250 psig
  0-500 psig
- **Helium Leak Integrity**
  1 x 10^{-6} scc/sec
- **Weight**
  10.0 lb
- **Cv**
  1.8
- **Flow**
  up to 5500 SCFH (air)

Materials

- **Bodies**
  Brass barstock
- **Diaphragms/Spring**
  316 stainless steel
- **Seat**
  PTFE
- **Seal**
  PTFE
- **Filter**
  10 micron

Ordering Information – Series PRS5033-ABC-CGA

A Material of Construction	B Outlet Pressure	C Assembly	CGA Pigtail
B: Brass S: Stainless Steel	0: 0- 125 psig 1: 0-250 psig 2: 0-500 psig	0: Standard Assembly 1: Audio/Visual Alarm	Please specify CGA

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ProSpec™ Series 5024 and 5025 Automatic Changeover System

The 5024 (brass) and 5025 (stainless steel) Changeover System is a fully automatic system designed to provide an uninterrupted flow of gas from two sources. When one source is in service providing the gas to process; the other source is on standby, and comes on-line when the current source has depleted. The changeover to the standby source occurs automatically.

Typically this system is used for single cylinder per side but can be configured for multiple cylinders per side please see page E•296 for header extensions.

Features and Benefits

- **Fully Automatic Operation**
  No levers or knobs to change
- **Fully Programmable Switchover Pressures**
  Reduces product waste
- **Separate Control and Alarm Box**
  Allows for flexibility during installations
- **Automatic Changeover**
  Continuous gas supply
- **Wall Mounted**
  Easy installation

Specifications

- **Maximum Inlet Pressure**
  3000 psig
- **Delivery Pressure Range**
  20-225 psig
- **Maximum Flow Rate**
  1200 scfh
- **Temperature Range**
  -20 °F to 148 °F
- **Pigtails**
  3' 316 stainless steel with armor jackets
  CGA – with check valve

Materials

- **Bodies**
  5024 series Brass Barstock
  5025 series 316 stainless steel
- **Diaphragms**
  316L
- **Seats/Seals**
  PTFE

Ordering Information – Series PRS5024AB (Brass) and Series PRS5025AB (Stainless Steel)

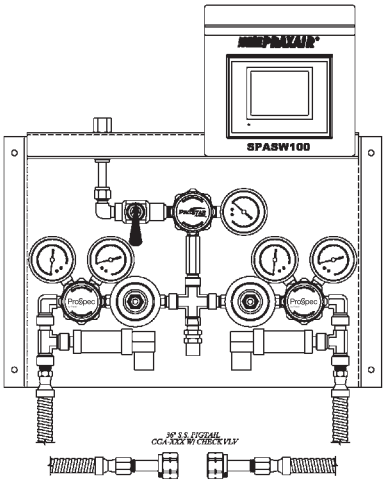
A Inlet connections Number of cylinders	B CGA
1: 1 x 1 2: 2 x 2 3: 3 x 3 4: 4 x 4 5: 5 x 5 6: 6 x 6 7: 6' flexible hoses	

Note: 5025 is not availabe for oxygen service.
Systems for oxygen service come standard with monel pigtails

Option	Part Number
100' Cable Extension	PRSP4302112
25' Cable Extension	PRSP4302113
100' Alarm Cable Extension	PRSP4302114
25' Alarm Cable Extension	PRSP4302115
Audio/Visual Alarm Cable Extension	PRSP4302104

Gas Delivery Systems

Fully Automatic Changeover Manifolds



ProSpec™ Auto 2

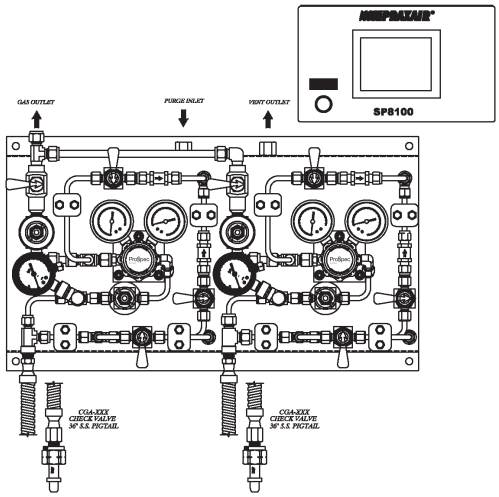
Based on the PRS5026 switchover design, the ProSpec Auto 2 is a fully automatic changeover system using the new PLC controller SPASW100. The SPASW100 is a touch screen controller that uses an analog input signal to control the switching of gas from one side to the other. The analog signal can be from a pressure transducer installed on the inlet side of the primary regulators, or from individual scale platforms monitoring weight of a liquefied gas cylinder. Simple Contact Style gauges can also be used. The controller also has an emergency shutdown feature and an additional fault input. The SPASW100 uses a pneumatic signal to control the switching between two pneumatically actuated high pressure valves.

Features and Benefits

- PLC Controller* With 3.5" Touch Screen Interface
- Fully Automatic Changeover Capability
- Can Auto Switchover on Pressure and Weight
- Emergency Stop Button Integral to Controller
- Additional Fault Input Capability
- 1X1 Design for pressures up to 3000 psig
- Outlet pressure range up to 400 psig

* Controller will require a regulated air source @85 psig

Other configurations and custom assemblies are available. Contact a Praxair representative for further details.



ProSpec Auto M5

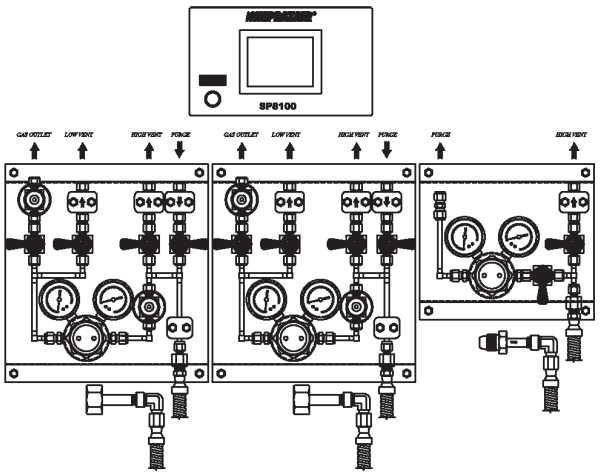
The Auto M5 is based on manual 5 valve process panels, with inert purging capabilities. By incorporating the PLC controller, SP8100, we can automate, and control switchover from side to side. The SP8100 is a touch screen controller that uses an analog input signal to control the switching of gas from one side to the other. The analog signal can be from a pressure transducer installed on the inlet side of the primary regulators, or from individual scale platforms monitoring weight of a liquefied gas cylinder. The controller also has an emergency shutdown feature and monitors 2 general and 6 safety faults. The SP8100 uses a pneumatic signal to controls the shutdown and auto switchover via 2 or 4 pneumatically actuated high pressure valves.

Features and Benefits

- PLC Controller* With 3.5" Touch Screen Interface
- Fully Automatic Changeover Capability
- Can Auto Switchover on Pressure and Weight
- Controls One or Two Panels
- Emergency Stop Button Integral to Controller
- Additional Fault Monitoring Capability
  - Displays analog reading of scale or transducer
  - Low Cylinder Alarm
  - Low Purge Source Pressure
  - High Outlet Pressure – Critical Fault & Shutdown
  - Toxic Monitor (Gas Detector) – Critical Fault & Shutdown
- Additional Fault Monitoring Capability, *continued*
  - Excess Flow (Flow Switch) – Critical Fault & Shutdown
  - Flame Detector – Critical Fault & Shutdown
  - Exhaust Failure (Stack or Exhaust Switch) Critical Fault
  - Remote Shutdown (Remote Stop) Critical Fault & Shutdown
- 1X1 Design for pressures up to 3000 psig
- Outlet pressure range up to 500 psig

* Controller will require a regulated air source @85 psig

Other configurations and custom assemblies are available. Contact a Praxair representative for further details.



ProSpec™ Auto MUHP5

The Auto MUHP5 is based on manual 5 valve process panels. The same features as the *ProSpec* Auto M5, but designed for ultra high purity applications, as well as some hazardous gas applications. The Auto MUHP5 incorporates a high and low pressure vent with inert purging capabilities. By incorporating the PLC controller, SP8100, we can automate, and control switchover from side to side. The SP8100 is a touch screen controller that uses an analog input signals to control the switching of gas from one side to the other. The analog signal can be from a pressure transducer installed on the inlet side of the primary regulators, or from individual scale platforms monitoring weight of a liquefied gas cylinder. The controller also has an emergency shutdown feature and monitors 2 general and 6 safety faults. The *ProSpec* Auto MUHP5 is an ideal platform for gas cabinet installations. We can provide this series in a full auto switchover with purge, 2 cylinder auto switchover, or a simple process purge. A single Auto MUHP5 panel can also be controlled by the SP8100.

Features and Benefits

- PLC Controller* With 3.5" Touch Screen Interface
- Fully Automatic Changeover Capability
- Can Auto Switchover on Pressure and Weight
- Controls One or Two Panels
- Emergency Stop Button Integral to Controller
- Additional Fault Monitoring Capability
  - Displays analog reading of scale or transducer
  - Low Cylinder Alarm
  - Low Purge Source Pressure
  - High Outlet Pressure – Critical Fault & Shutdown
- Additional Fault Monitoring Capability, *continued*
  - Toxic Monitor (Gas Detector) – Critical Fault & Shutdown
  - Excess Flow (Flow Switch) – Critical Fault & Shutdown
  - Flame Detector – Critical Fault & Shutdown
  - Exhaust Failure (Stack or Exhaust Switch) Critical Fault
  - Remote Shutdown (Remote Stop) Critical Fault & Shutdown
- 1X1 Design for pressures up to 3000 psig
- Outlet pressure range up to 500 psig

* Controller will require a regulated air source @85 psig

Other configurations and custom assemblies are available. Contact a Praxair representative for further details.

ProSpec Auto MUHP5 – Custom Cabinet Application

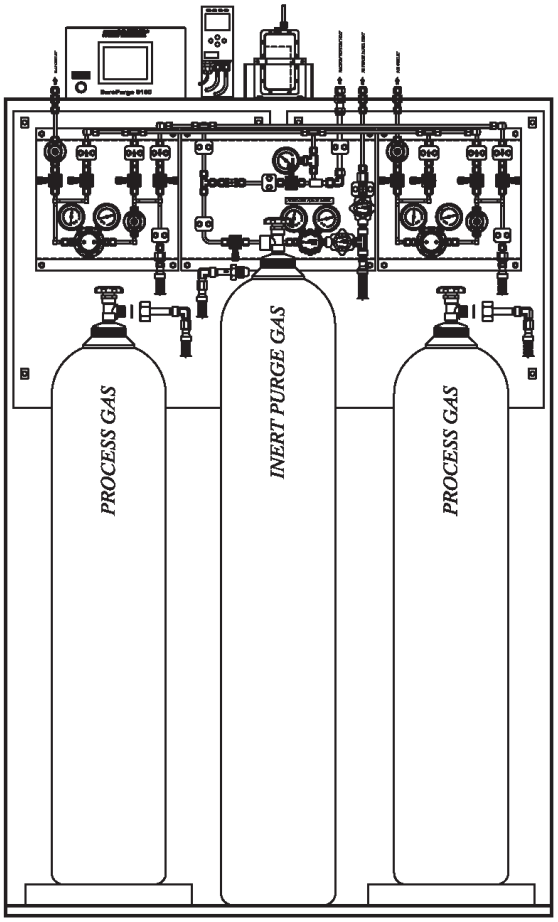
The Auto MUHP5 panels can be configured into various custom configurations. They can also be configured into several sizes of gas cabinet enclosure. Panel feature and configurations are dependent on local and international safety codes and gas type.

Features and Benefits

As pictured:

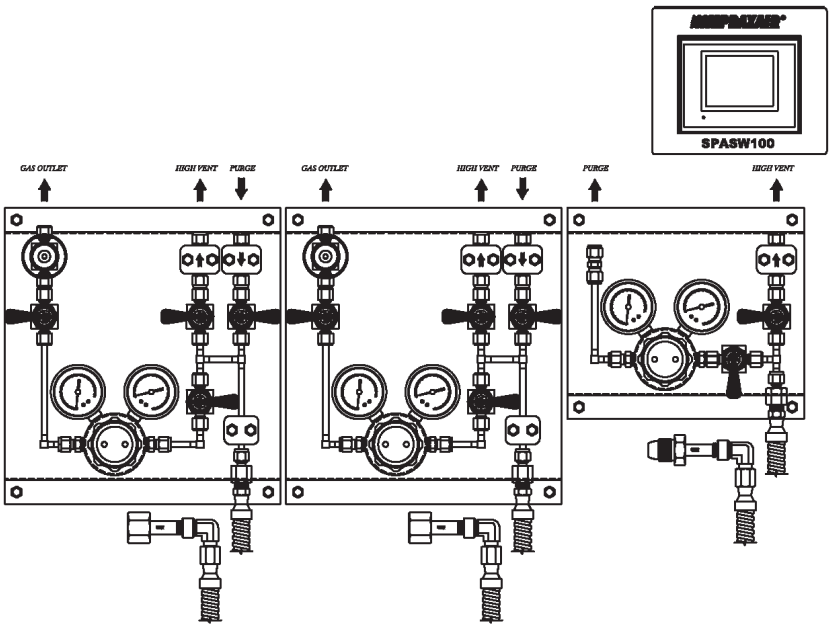
- Custom 3 Cylinder Cabinet – Large Diameter Process Gas Cylinder
- Fully Automatic Changeover – Dual outlet ports
- Auto Switchover on Weight – Liquefied Contents
- Emergency Stop Button Integral to Controller
- Additional Fault Monitoring Capability
  - Displays analog reading of scale Panel 1 & 2
  - Low Cylinder Alarm
  - Low Purge Source Pressure – Purge Cylinder Contents
- Additional Fault Monitoring Capability, *continued*
  - High Outlet Pressure – Critical Fault & Shutdown
  - Toxic Monitor (Gas Detector) – Critical Fault & Shutdown
  - Exhaust Failure (Stack or Exhaust Switch) Critical Fault
  - Remote Shutdown (Remote Stop) Critical Fault & Shutdown
- 1X1 Design for pressures up to 3000 psig
- Outlet pressure range up to 500 psig

* Controller will require a regulated air source @85 psig



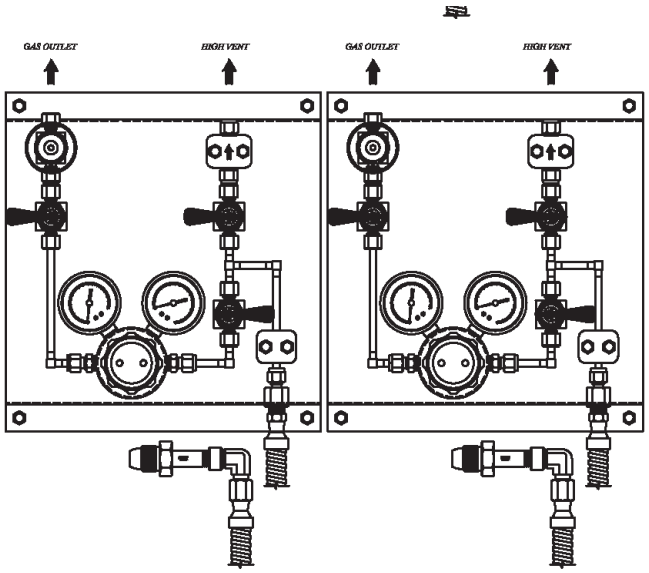
Gas Delivery Systems

Fully Automatic Changeover Manifolds



ProSpec™ Auto MUHP4 and Auto MUHP3

The Auto MUHP4 and MUHP3 are based on manual 2, 3, and 4 valve process panels, with inert purging capabilities. By incorporating a PLC controller, SPASW100, we can automate, and control switchover from side to side. The SPASW100 is a touch screen controller that uses an analog input signal to control the switching of gas from one side to the other. The analog signal can be from a pressure transducer installed on the inlet side of the primary regulators, or from individual scale platforms monitoring weight of a liquefied gas cylinder. Simple Contact Style gauges can also be used. The controller also has an emergency shutdown feature and an additional fault input. The SPASW100 uses a pneumatic signal to control the switching between two pneumatically actuated high pressure valves.



Features and Benefits

- PLC Controller* With 3.5" Touch Screen Interface
- Fully Automatic Changeover Capability
- Can Auto Switchover on Pressure and Weight
- Emergency Stop Button Integral to Controller
- Additional Fault Input Capability
- 1X1 Design for pressures up to 3000 psig
- Outlet pressure range up to 400 psig

* Controller will require a regulated air source @85 psig

Other configurations and custom assemblies are available. Contact a Praxair representative for further details.

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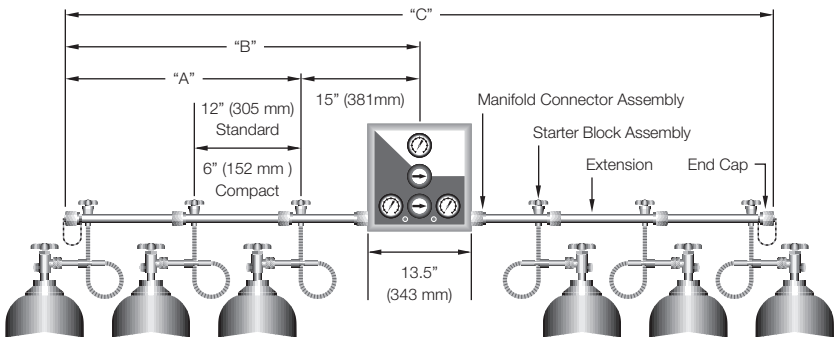
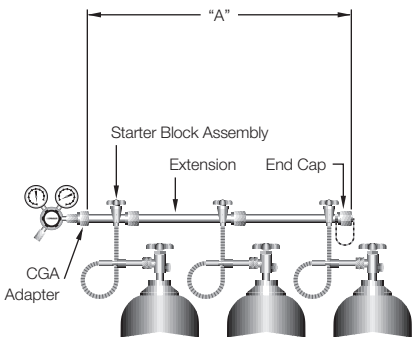
Critical Purity Manifolds

The modular gas distribution system is a flexible modular manifold designed for centralized distribution of high purity gases regardless of facility constraints. Each station has an integral diaphragm valve for shut-off and gas purity protection. The modular design facilitates expansion as gas requirements increase. Each system comes complete with a flexible, all stainless steel pigtail with armor casing. Inter connecting piping is all welded which allows for a tighter seal. The CGA connection on each pigtail has a check valve in the gland to prevent contamination and minimize purging requirements.

Features and Benefits

- **Modular Design**
  Flexible field installation
- **Internal Diaphragm Valves**
  Leak-tight integrity
- **Variable Line Pressure**
  Line pressure changeable on-site
- **Brass**
  Reduces possibility of gas contamination
- **Metal-to-Metal Joints**
  Easy field assembly and transportation
- **Silver-Brazed Modules**
  Clean installation





Specifications (Brass Headers)

- **Maximum Inlet Pressure**
  3000 psig (2310 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Connections**
  Pigtail inlet: 1/4" FPT
  Outlet: 1/4" FPT
- **Header**
  Brass (0.625" OD x 0.095" wall, silver soldered)
- **Diaphragm Valve**
  Brass barstock (body)
  KEL-F® (seat)
  316 stainless steel (stems)
  316 stainless steel (diaphragms)

Specifications (Stainless Steel Headers)

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Connections**
  Pigtail inlet: 1/4" FPT
  Outlet: 1/4" FPT
- **Header**
  316 stainless steel
  (0.625" OD x 0.095" wall, orbital welded)
- **Diaphragm Valve**
  316 stainless steel (body)
  KEL-F® (seat)
  316 stainless steel (stems)
  316 stainless steel (diaphragms)

Dimensions

Cylinders per Extension	1	2	3	4	5	6	7	8	9	10
"A" Standard (single or double)	6"	18"	30"	42"	54"	66"	78"	90"	102"	114"
"B" Standard (single or double)	15"	27"	39"	51"	63"	75"	87"	99"	111"	123"
"C" Standard (single or double)	30"	54"	78"	102"	126"	150"	174"	198"	222"	246"
Weight Standard (single)	5.7 lb	11.8 lb	17.9 lb	24.0 lb	31.1 lb	36.2 lb	42.3 lb	48.4 lb	54.5 lb	60.6 lb
Weight Standard (double)	6.6 lb	12.7 lb	18.8 lb	24.9 lb	32.0 lb	37.1 lb	43.2 lb	49.3 lb	55.4 lb	61.5 lb
"A" Compact (single or double)	6"	12"	18"	24"	30"	36"	42"	48"	54"	60"
"B" Compact (single or double)	15"	21"	27"	33"	39"	45"	51"	57"	63"	69"
"C" Compact (single or double)	30"	42"	54"	66"	78"	90"	102"	114"	126"	138"
Weight Compact (single)	5.7 lb	11.2 lb	16.7 lb	22.2 lb	27.7 lb	33.2 lb	38.7 lb	44.2 lb	49.7 lb	55.2 lb
Weight Compact (double)	6.6 lb	12.1 lb	17.6 lb	23.1 lb	28.6 lb	34.1 lb	39.6 lb	45.1 lb	50.6 lb	56.1 lb

"A", "B", and "C" refer to the lengths specified on the diagram below

Ordering Information – Series PRS502BABCD-CGA (Brass) and Series PRS502SABCD-CGA (316L Stainless Steel)

A – Switching Pressure

- 1: Standard Single Row (right or left extension)
- 2: Standard Double Row (two pigtails per station)
- 3: Standard Duplex (right and left extensions)
- 4: Compact Single Row (right or left extension)
- 5: Compact Double Row (two pigtails per station)
- 6: Compact Duplex (right and left extensions)

B – Cylinders/Side

- 0: 10 cylinders
- 1: 1 cylinder
- 2: 2 cylinders
- 3: 3 cylinders
- 4: 4 cylinders
- 5: 5 cylinders
- 6: 6 cylinders
- 7: 7 cylinders
- 8: 8 cylinders
- 9: 9 cylinders

C – Pigtail Style

- 0: None
- 2: Flexible 316 Stainless Steel, 24", with Check Valve
- 3: Flexible 316 Stainless Steel, 36", with Check Valve
- 6: Flexible 316 Stainless Steel, 72", with Check Valve

D – Outlet

- 1: 1/4" FPT
- 2: With CGA Adapter

CGA – Inlet Connection

Please specify inlet CGA

5028 Rack and Roof Systems

The 5028B (Brass) and 5028S (316 Stainless Steel) Rack and Roof systems have been developed with safety and security in mind. These high quality mounting systems can be used in the lab or outside. The racking system is designed to be mounted to a suitable floor surface to safely secure cylinders and when properly mounted meets NFPA requirements, while the roof system offers protection for outside Installations.

These high quality roof/rack systems come complete with Praxair's *ProSpec*™ 5028 changeover manifold systems already installed.

Features and Benefits

- **Ease of Securing Cylinders**
  Helps ensure NFPA compliance
- **User Friendly Changeover System**
  One knob switches cylinder priority
- **Flexible Pigtails**
  3' – 316 stainless steel with armor casing Monel® for oxygen service
- **Check Valves in Inlet Gland**
  Helps prevent contamination and back flow
- **Modular Construction**
  Allows for easy installation, modular design for a smaller foot print

Specifications

- **Rack System**
  Welded mild steel:
  Powered coated white for inside installations
  Powered coated grey for outside installations
- **Roof**
  304 Stainless Steel
- **The 5028B (Brass) and 5028S (316 Stainless Steel) Series High Purity Automatic Changeover Systems**
  (see page E•286)

Ordering Information – *ProSpec* PRS5028 Racking System

PRS5028 Systems with Rack Option – Brass or Stainless Steel
2 Cylinder Process Racks – Awning/Rain Shield Option

A		B – Line Regulator Outlet			C – Assembly		D – Rack System		E – Outdoor Cover		F – Cyl. Connection
Material	Option	Designation	Option	Outlet Guage	Designation	Option	Designation	Option	Designation	Option	Connection Number
B	Brass	0	0-25	30"-0-60	0	Std. Assembly	0	No Cyl. Rack	0	No Awning	Specify
S	Stainless Steel	1	0-50	30"-0-100	1	With Alarm	1	With 2 Cyl. Rack	1	With Weather Awning	
		2	0-100	30"-0-200							
		3	0-150	30"-0-200							

Note: Floor mounting hardware not included.

Contact your local Praxair representative to assist you in selecting the right configuration for your application.

Option

Other configurations are available. Please contact your local Praxair representative for further information.

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Protocol Rack and Roof Systems

These systems have been developed with safety and security in mind. These high quality mounting systems can be used in the lab or outside. The racking system is designed to be mounted to a suitable floor surface to safely secure cylinders and when properly mounted meets NFPA requirements, while the roof system offers protection for outside Installations.

These high quality roof/rack systems come complete with multiple regulator configurations and options.

Features and Benefits

- **Ease of securing cylinders**
  Helps ensure NFPA compliance
- **User Friendly Changeover System**
  One knob switches cylinder priority
- **Flexible Pigtails**
  3' – 316 stainless steel with armor casing Monel® for oxygen service
- **Check Valves in Inlet Gland**
  Helps prevent contamination and back flow
- **Modular Construction**
  Allows for easy installation, modular design for a smaller foot print

Specifications

- **Rack System**
  Welded mild steel:
  Powered coated white for inside installations.
  Powered coated grey for outside installations
- **Roof**
  304 Stainless Steel
- **Regulator**
  Reference the specifications section for the desired regulator. Use the listing on page E•241 to find the page number

Protocol racks must be used with compatible gas service.

Ordering Information – *ProSpec™* Regulator Racking System

Single – Multi-regulator wall mounting system
1, 2 and 3 Cylinder Process Racks – Awning/Rain Shield Option

Mounting Station

PRS	R	A
ProSpec	Racking System	Number of Stations
		1
		2
		3

Station Positon #1

B		C		D	
Designation	Option	Designation	CGA Number	Designation	Pressure
1	PRS4012	1	580	1	0-15
2	PRS4002	2	590	A	0-40
3	PRS4032	3	540	2	0-50
4	PRS4022	4	350	3	0-100
5	PRS3012	5	320	B	0-120
6	PRS3002	6	510	C	0-200
7	PRS3032	7	326	4	0-250
8	PRS3022	8	330	5	0-500
9	PRS2012	9	660	7	0-150
A	PRS2002	A	680	8	0-750
B	PRS4092	B	703	9	0-1500
C	PRS4093	C	677	D	0-2500
				E	0-4500
				F	0-6000

Station Positon #2

E		F		G	
Designation	Option	Designation	CGA Number	Designation	Pressure
0	None	0	None	1	0-15
1	PRS4012	1	580	A	0-40
2	PRS4002	2	590	2	0-50
3	PRS4032	3	540	3	0-100
4	PRS4022	4	350	B	0-120
5	PRS3012	5	320	C	0-200
6	PRS3002	6	510	4	0-250
7	PRS3032	7	326	5	0-500
8	PRS3022	8	330	7	0-150
9	PRS2012	9	660	8	0-750
A	PRS2002	A	680	9	0-1500
B	PRS4092	B	703	D	0-2500
C	PRS4093	C	677	E	0-4500
				F	0-6000

Station Positon #3

H		I		J	
Designation	Option	Designation	CGA Number	Designation	Pressure
0	None	0	None	1	0-15
1	PRS4012	1	580	A	0-40
2	PRS4002	2	590	2	0-50
3	PRS4032	3	540	3	0-100
4	PRS4022	4	350	B	0-120
5	PRS3012	5	320	C	0-200
6	PRS3002	6	510	4	0-250
7	PRS3032	7	326	5	0-500
8	PRS3022	8	330	7	0-150
9	PRS2012	9	660	8	0-750
A	PRS2002	A	680	9	0-1500
B	PRS4092	B	703	D	0-2500
C	PRS4093	C	677	E	0-4500
				F	0-6000

Awning

K	
Designation	Option
1	No Awning
2	With Weather Awning

Option

Other configurations are available. Please contact your local Praxair representative for further information.

Gas Delivery Systems

Control Panels

Typical Applications

Used on corrosive and high purity gases for ultimate safety in cylinder changeouts. Panels can be located in gas cabinets, please see page E•305 for further details.

Regulator Control Panel

Three Valve Control Panel

Five Valve Control Panel

Features and Benefits

- **Brushed Stainless Steel Panel**
- **Wall Mounted to Protect the Regulator**
- **Labeled for Gas Service**
  Durability and gas service differentiation
- **4000 & 3000 Series Regulators CGA Connection**
  No integral contamination during cylinder changeout
- **Purge Capability of the 3- and 5-Valve Regulator Stations**
  Helps maintain gas purity and prevents contact with flammable or toxic gases
- **Mountable to Any Suitable Surface**
  Easy installation
- **Metal-to-Metal Diaphragm Seal**
  Reduces possibility of internal gas contamination
- **Low Wetted Surface Area**
  Minimal purge requirements
- **Cv Regulator**
  0.1
- **316L Stainless Steel Diaphragm**
  No inboard diffusion

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Ports**
  1/4" FPT
- **Helium Leak Integrity**
  1 x 10^{-9} scc/sec

Materials

- **Regulator**
  High purity brass or 316L stainless steel barstock 4000 series regulators
- **Diaphragms**
  316L stainless steel
- **Seats**
  PTFE Teflon®
- **Pigtail Innercore**
  316 stainless steel, Monel when used with oxygen
- **Pigtail Braid**
  304 stainless steel (2 layers)
- **Pigtail Armor Casing**
  304 stainless steel
- **Valves**
  Brass or stainless steel, high purity diaphragm valves
- **Fittings**
  Compression or NPT, brass or stainless steel
- **Tubing**
  316/316L stainless steel or copper
- **Check Valves**
  Brass or stainless steel
- **Check Valve O-Ring**
  Viton®

Ordering Information – Series PRS5RSABCDEF (Regulator Control Panel)

A	B		C	D	E	F
Material	**Pressure**		**Number of Stages**	**Pigtail**	**CGA**	**Outlet****
B: Brass	1: 15 psi	5: 500 psi	1: 1 Stage (no purge)	1: 36"	Specify	0: 1/4" Tube
S: Stainless	2: 50 psi	7: 150 psi	2: 2 Stage (no purge)	2: 72"		1: 1/8" Tube
	3: 100 psi		8: 1 Stage (w/purge)*			2: 1/4" FPT
	4: 250 psi		9: 2 Stage (w/purge)*			3: 1/4" MPT

* With purge means block and purge valves
** Multi turn diaphragm valve standard

Ordering Information – Series PRS5MVABCDEF (MultiValve Control Panel)

A	B		C	D	E	F
Material	**Pressure**		**Number of Valves**	**Pigtail**	**CGA**	**Outlet****
B: Brass	1: 15 psi	4: 250 psi	3: 3 Valves	1: 36"	Specify	1: One stage
S: Stainless	2: 50 psi	5: 500 psi	5: 5 Valves	2: 72"		2: Two stage
	3: 100 psi	7: 150 psi				

For modifications or custom configurations, please contact your Praxair representative or call 1-877-PRAXAIR.

Gas Delivery Systems

Praxair's *VersiGas*™ Lab System

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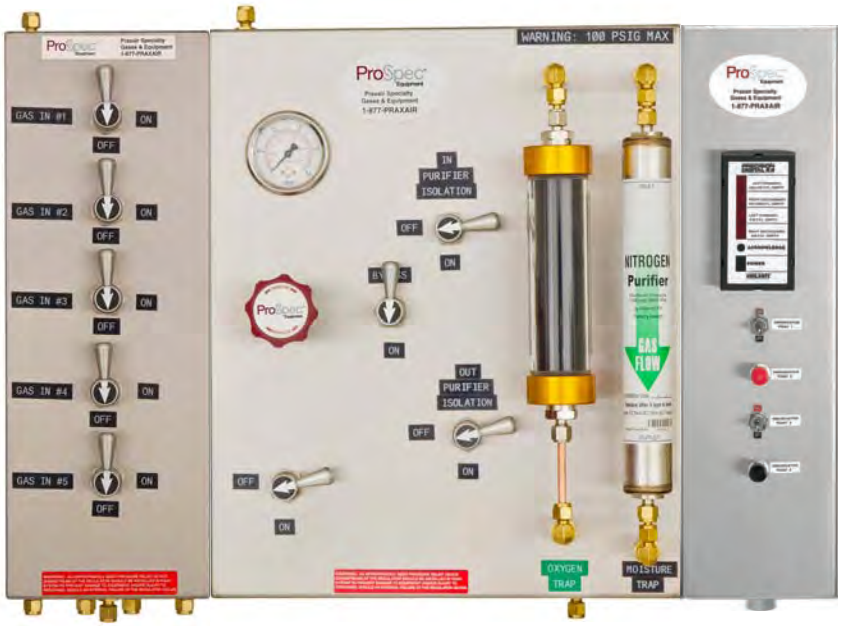
The *VersiGas*™ Lab Systems have been designed to provide point of use control in the laboratory, they are meant as a secondary pressure reduction from changeover systems. They offer today's laboratories great flexibility when designing gas delivery systems aimed at meeting specific point of use gas concerns. As new instruments are added to meet increasing demands for the laboratory, gas piping systems can grow into a tangle of tubing, line regulators and traps, making it difficult to carry on preventative maintenance. *VersiGas* Lab Systems eliminate this concern and makes it much easier to install gas handling equipment in the laboratory.



Typical layout for 5 points of use with purification bypass system and audio/visual alarms from the gas room. System components maybe purchased separately please see page E•302 for more details.

Convenience –

VersiGas Lab Systems are shipped in convenient sections, easily added or removed, to accommodate your specific application, and are rated with an inlet pressure of 3000 psig, this provides added safety at the point of use.

- Shipped assembled and tested, minimizing installation time and cost
- Ease of use helps increase lab productivity
- Customizable
- Versatile
- Modular
- Rail mounting system easily adapted to any environment
- Sections connected to rails via brass thumbscrews, no tools required
- Ideal for future expansion, blank sections and custom length rails available
- Annunciator section supplied in 3 pieces so the unit can be removed without disturbing wiring conduits

Quality –

The *VersiGas* Lab System is designed, cleaned and built to ensure high quality standards.

- Flexible design to meet specific gas needs
- Engineered to ensure gas purity and leak integrity
- Constructed with the highest quality material available
- Each section is assembled and leak tested before shipment, minimizing installation time and cost
- All tubing ends are "faced" to ensure full flow and to prevent contaminant entrapment zones

Safety –

Gas tubing from centralized gas handling rooms may be directly connected to the *VersiGas* Lab System panels, eliminating the need to locate cylinders within the laboratory.

- Cylinders placed in safe storage areas
- Helps to create a safer working environment
- Reduces cylinder handling
- Consolidates cylinder inventories
- Helps you meet Local and National Fire Codes (NFPA)

Appearance –

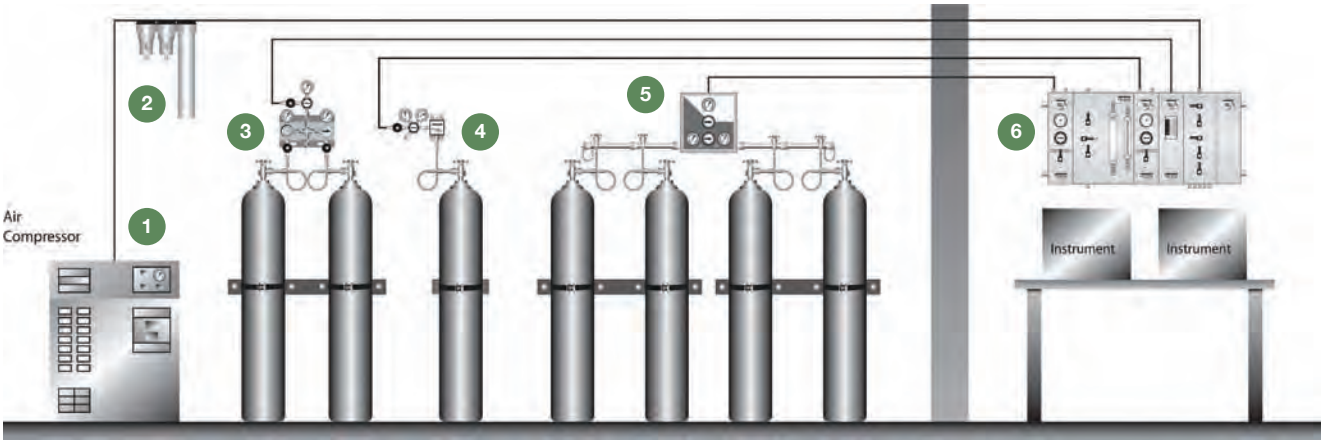
The *VersiGas* Lab System is packaged in a neat and attractive manner creating a uniform appearance throughout the laboratory.

- Aesthetically pleasing
- All panels are constructed of brushed stainless steel
- No paint chipping or staining to worry about
- All panels are fully formed and seam welded, no mounting brackets, which can break off

Please contact your local Praxair representative to assist you with design requirements. Praxair can design panels and systems to fit most any need.

Gas Delivery Systems

Praxair's *VersiGas*™ Lab System



1. Air Compressor
2. Membrane N_2 (page E•331)
3. 5026/5027 Series Switchover (page E•285)
4. Protocol Station (pages E•282)
5. 5022/5023 Series Switchover (page E•284)
6. Gas Point of Use Panels (pages E•302 and E•303)

Applications

Designed to act as a secondary point of use control from the gas room for point of use pressure control of high purity gas delivery applications including:

- Gas and liquid chromatography
- Ultra high purity carrier gases
- Zero, span, fuel, and calibration gases
- Cryogenic gases (vapor phase)
- Pharmaceutical manufacturing
- High purity chamber pressurization
- Gas supply for analyzer valve actuation.

Features and Benefits

- **All-in-one Pressure Control, Purification and on/off Valve**
  Convenient, high purity gas delivery system
- **In Laboratory Point of Use Control**
  Cylinders located safely in dedicated gas handling areas
- **Completely Assembled**
  Quick and easy installation
- **Rail Mounting System**
  Allows panel to be mounted to the wall, to a bench or to vertical rails hung from the ceiling
- **Pressure Tested Individual Sections**
  Provides flexibility when locating point-of-use panels in the laboratory

Specifications

- **Sections Dimensions**
  All sections are 18" (45.7 cm) high, and the panel face to wall dimension, when mounted, is 6" (15.2 cm) deep. Section width dependent on the section type:
  - Regulator Section and Annunciator Section, 5" W (12.7 cm)
  - Valve Section, 6.7" W (17 cm)
  - Regulator Section with Purifiers in Series or Parallel, 15" W (38.1 cm)
  - Regulator Section with One Purifier, 10" W (25.4 cm)
  - Purifier Section with Purifiers in Series, 10" W (25.4 cm)
  - Purifier Section with Purifiers in Parallel, 15" W (38.1 cm)
  - Blank sections, as required for any of the above
- **Delivery Pressure Range and Gauge Scale**
  0-15 psig; 0-30 psig; 0-60 psig; 0-100 psig, 0-160 psig; 0-200 psig
- **Gas Specific Purifiers**
  Helium (inert gases, argon); hydrogen; nitrogen; air maximum flow, 500 ml/min
- **Indicating Glass Moisture Traps**
  250 cc
- **Non-Indicating Traps**
  Moisture; hydrocarbon; oxygen maximum flow, 500 ml/min
- **Indicating Oxygen Trap**
  Can be used to show gas specific purifier break through when tubed in series

Materials

- **Panels**
  Brushed stainless steel panels, and stainless steel mounting rails
- **Regulators**
  High purity series 3000 or 4000 brass or stainless steel barstock bodies, with stainless steel diaphragms
- **Valves**
  Brass or stainless steel, high purity 1/4 turn directional diaphragm valves (Ball valves are not used because of stem seal leakage, and large internal areas where impurities can be trapped)
- **Fittings**
  Compressor or NPT, brass or stainless steel
- **Tubing**
  316/316L stainless steel for all applications (SS ferrules used with brass fittings)
  - All tubing ends are "faced" (as would be done for "orbital welding") to ensure full flow, and to prevent contamination entrapment zones
  - Cleaned to gas chromatograph grade and oxygen service

Praxair's *VersiGas*™ Numbering System

Mounting rails and thumb screws are supplied with each section. When multiple units (modules or sections) are to mount together as an assembly, specify, so full length rails can be supplied for the assembly.

A – Regulator Section – 5MV Series

A high purity single stage regulator (either brass or stainless steel) is supplied with a high purity, 1/4 turn, diaphragm valve and gauge to give you accurate control of pressure at your point-of-use.

Ordering Information – Series PRS5MVABCD (Regulator Panel)

A	B	C	D
Material	**Pressure**	**Inlet Connection**	**Outlet Connection**
B: Brass S: Stainless	100: 15 psig 200: 50 psig 300: 100 psig 400: 250 psig 500: 500 psig 700: 150 psig	0: 1/4" Tube 1: 1/8" Tube 2: 1/4" FPT	0: 1/4" Tube 1: 1/8" Tube 2: 1/4" FPT

B – Valve Outlet Section – 5VA Series

These panels take a single gas inlet from a regulator section or purifier section, and give you from one to five separate outlets. Each outlet is controlled by a high purity, 1/4 turn, diaphragm valve (either brass or stainless steel).

Ordering Information – Series PRS5VAABCDE (Valve Panel)

A	B	C	D	E
Material	**Pressure**	**Number of Valves**	**Inlet Connection**	**Outlet Connection**
B: Brass S: Stainless	3: 3000 psig max.	30: 3 Valves 40: 4 Valves 50: 5 Valves	0: 1/4" Tube 1: 1/8" Tube 2: 1/4" FPT	0: 1/4" Tube 1: 1/8" Tube 2: 1/4" FPT

C – Regulator Section with Purifiers/Traps in Series – 5VP Series

For both modules "A" and "B" above, are combined into a single unit for your convenience.

Ordering Information – Series PRS5VPABCDEF (Purifier Panel with regulator)

A	B	C	D	E	F
Material	**Pressure**	**Trap Type 1**	**Trap Type 2**	**Inlet Connection**	**Outlet Connection**
B: Brass S: Stainless	100: 15 psig 200: 50 psig 300: 100 psig 400: 250 psig 500: 500 psig 700: 150 psig	0: Purifier 1: Hydrocarbon 2: Moisture	0: Purifier 1: Hydrocarbon 2: Moisture	0: 1/4" Tube 1: 1/8" Tube 2: 1/4" FPT	0: 1/4" Tube 1: 1/8" Tube 2: 1/4" FPT

Gas Delivery Systems

Praxair's Multi-Gas Point-of-Use Panels

Praxair's standard line of Multi-Gas Point-of-Use Panels allow from one to five gases to be effectively pressure-controlled to one or multiple instruments or use points in your laboratory. Praxair can custom design these panels to fit your application or space requirements, and can supply up to 60 points of use on single panels. Please contact your local Praxair representative if large systems are required.

Features and Benefits – Catalog Standard Panels

- Up to five single stage, high-purity brass or stainless steel regulators.
- 1/4 turn directional high-purity diaphragm valves for each regulator.
- Two piping configurations – multiple gases inlets and outlets, or a single gas inlet with up to five outlets.
- Horizontal or vertical mounting require a minimal laboratory space.
- Horizontally-mounted panels can be supplied in two variations:
  - Regulators, valves and tubing mounted behind the panel surface (Bonnet-Mounted Regulators).
  - Regulators mounted to the surface of the panel, with valves and gauges attached directly to the regulators (Surface-Mounted Regulators).
- Vertically-mounted panels can be supplied with the outlet connections exiting the right side or the bottom of the panel, or designed to fit you're application.
- 316 stainless steel tubing, cleaned to gas chromatograph grade.
- Fully welded, brushed stainless steel panel.
  - Rated to 3000 psi working pressure
  - Added safety

Materials

- **Panels**
  Fully welded brushed stainless steel
- **Mounting Rails**
  Stainless steel, with thumb screws for easy mounting
- **Regulators**
  High purity brass or stainless steel, 3000 Series regulators
- **Valves**
  Brass or stainless steel, 1/4 turn, high purity diaphragm valves
- **Tube Fittings**
  Brass or stainless steel, compression fittings and NPT
- **Tubing**
  316L stainless steel and copper cleaned to gas chromatograph grade and oxygen service

Vertical Mounted Sections

Vertical Surface Mounted Sections

Horizontal Mounted Sections

Ordering Information –
Series PRS5MPABCDEFG (Bonnet-Mounted Regulators) and Series PRS5MSABCDEFG (Surface-Mounted Regulators)

A	B	C	D	E	F	G
Material	**Pressure**	**Number of Regulators**	**Type**	**Inlet**	**Outlet**	**Orientation**
B: Brass S: Stainless	1: 15 psi 2: 50 psi 3: 100 psi 4: 250 psi 5: 500 psi 7: 150 psi	1: 1 Regulator 2: 2 Regulators 3: 3 Regulators 4: 4 Regulators 5: 5 Regulators	1: Individual Inlets 2: Combined Inlets	0: 1/4" tube 1: 1/8" tube 2: 1/4" FPT	0: 1/4" tube 1: 1/8" tube 2: 1/4" FPT	0: Horizontal 1: Vertical

For larger non-standard configurations, please contact your local Praxair representative.

PRAXAIR
Making our planet more productive

Praxair UHP (Ultra High Purity) Gas Cabinet Systems

The *ProSpec*™ UHP series gas cabinets offer the safest and most reliable means to deliver Hazardous and Non-Hazardous gases. *ProSpec* cabinets feature Semiconductor Grade components and are widely used throughout the Micro and Nanotechnology Industries. All models feature high integrity VCR fittings and 316L EP (Electropolished) Wetted Components. The control systems utilize state of the art PLC's (Programmable Logic Controllers) to provide non-interruptible gas service from small to very large scale gas delivery systems. Manual to Fully automatic versions are available. Pulse/Purge cylinder change systems provide a high level of safety and gas purity by removing residual process gas and contaminants during cylinder change and maintenance operations.

Benefits

- UHP Gas Delivery
- Indoor/Outdoor Installations
- Limit personnel exposure
- Safety and Security – Locking Door Standard
- Meets or Exceeds Code Requirements for HPM Gases

Typical Configurations

- **One Cylinder Cabinet – Process Cylinder**
  - Regulator Panel with Pulse/Purge
  - SP100 PLC Controller
  - 6 Valve Panel
  - Custom Panel Assembly Available by Request and Safety Review
  - Requires exterior Purge panel
- **Two Cylinder Cabinet – Process/Process or Process/Purge**
  - Regulator Panels with Pulse/Purge
  - SP1000 PLC Controller
  - 6 Valve Panel
  - Semi-Automatic Switchover
  - Semi-Automatic with purge
  - Automatic Switchover
  - Automatic with Purge
  - Dual Process Outlet
  - Custom Panel Assemblies Available by Request and Safety Review
  - Autoswitchover requires external purge panel
- **Three Cylinder Cabinet – Process/Process/Purge (Gas Dependent)**
  - Regulator Panels with Pulse/Purge
  - SP1000 Controller
  - 6 Valve Panels
  - Semi-Automatic Switchover with Purge
  - Automatic Switchover with Purge
  - Custom Panel Assemblies Available by Request and Safety Review

Standard Features

- 11 Gauge Steel construction with powder coat finish
- Exhausted Enclosure with efficient design to reduce facilities exhaust requirements
- Self closing door and access window
- Exhaust monitor alarms if facilities exhaust fan fails
- Built in Sprinkler to meet NFPA codes
- Excess Flow Switch
- Vent and N_2 purge systems for removing process gas during cylinder change
- Automatic cylinder switchover based on cylinder pressure or weight provides 24/7 gas availability

Cabinet Accessories

- Cylinder Shelf
- Scales
- Gas Detection System – Internal Sensor with Gas Detection Controller/Alarm
- UV/IR Detection (Flammable and Pyrophoric gases)
- Heat Switch (Flammable gases)
- Coaxial outlets with or without monitoring
- Outlet filter (.003 micron)
- Weld port on outlet allows ease of process line installation

Specialized – Gas Dependent Options

- DISS or CGA Pigtail connection
- UV/IR Detection (Flammable and Pyrophoric gases)
- Heat Switch (Flammable gases)
- Open Rack systems for Pyrophoric gases stored outdoors

Standard SP100 and SP1000 Controller Features

- PLC Controllers
- Color Touchscreen Operator Interface
- Automatic Purge Routines
- Customer Configurable Alarms
- Remote Monitoring Capability
- 4 level Customer programmable security codes to prevent unauthorized access
- Remote Monitoring capabilities

Please consult your local Praxair representative for a wide range of options when ordering Ultra High Purity Gas Cabinet Systems. We're here to help!

Gas Delivery Systems

Laboratory Gas Cabinets

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. Each gas cabinet has a steel panel installed to facilitate a simple regulator up to a fully customized gas handling system. 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.
- 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.

Specifications

- All welded construction using 11 GA steel.
- Epoxy coated for maximum UV protection.
- 1/4" thick, wire reinforced safety glass window.

Ordering Information

Part Number	Capacity	Height in (cm)	Width in (cm)	Depth in (cm)
PRS7100	1 cylinder	72 (183)	18 (46)	18 (46)
PRS7200	2 cylinder	72 (183)	24 (61)	18 (46)
PRS7300	3 cylinder	72 (183)	36 (91)	18 (46)
PRS7400*	4 cylinder	72 (183)	48 (122)	18 (46)

* Four cylinder cabinets not approved for storage or use with some gases, Please verify NFPA gas volume requirements.

Option	Part Number
Cylinder shelf	PRS7001
Dome roof configurations	PRS7003
Keyed door latch	PRS7005
Air intake filter	PRS7010
Custom cabinets	Contact your Praxair representative
Rubber floor mat	PRS7013

For complete gas cabinet systems, please see pages E·306 and E·307. You can also contact your local Praxair representative or call 1-877-PRAXAIR.

Semiconductor Gas Cabinets, Panels and Controllers

Praxair's one-, two- and three-cylinder gas cabinets are reliable, easy to use, and are designed with safety as a priority.

Easy to Use

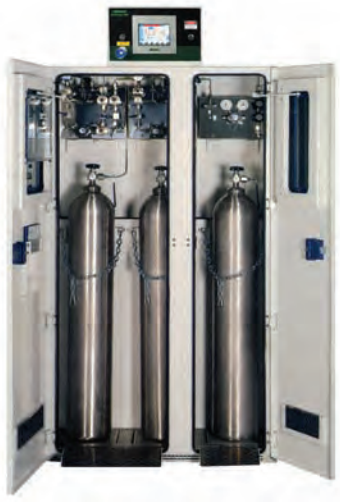
- Self-retracting cylinder ramps assist cylinder changeout
- Recessed cylinder scales
- Skylights for improved internal ambient lighting
- PLC *(SurePurge™)* or Microprocessor *(UltraPurge™)* controllers with intuitive operation
- Minimum 140° door opening allows unencumbered access
- Replaceable bulkhead adapter plates for simplified customer installation

Safe

- Air intake filters and diffuser for continuous, positive ventilation
  - Efficient enclosure design reduces facilities exhaust requirements – less than 200 standard cubic feet/minute (scfm) air flow through the dual cylinder model (300 scfm through three cylinder enclosure)
  - Self-closing, self-latching windows and doors
- Raised, perforated floor and bottom filtered air intake eliminate dead pockets around cylinder base
- UL approved fire sprinkler
- UV/IR detection for pyrophoric gases
- Four-level passcode protected on controllers to prevent unauthorized use
- Integrated to accept multiple customer fault inputs
- CE approved on *UltraPurge* (UP) models, SEMI® S2 on *SurePurge* (SP) models

Cabinet Configurations

- One-, two- or three-cylinder cabinets available on *SurePurge* and *UltraPurge* models
  - One cylinder cabinet with single process gas panel
  - Two cylinder cabinets available in process/process or process/purge configuration
  - Three cylinder cabinets available in process/process/purge configuration
- *SP8100* model panels
  - WP5M semiautomatic panel offers safe, basic gas operation
  - Manual purge and vent systems reduce cost
  - UP2 purge panel provides inert gas for maintenance operations
- *UltraPurge* model panels
  - Automatic valve panels (UP6 – standard, UP8 – high pressure purge)
  - UP2 purge panel provides inert gas for maintenance operations
- *SurePurge* model panels
  - UP10 with dual valve isolation on purge and vent system provides the most reliable panel available
  - UP2 purge panel provides inert gas for maintenance operations



UltraPurge™ 400 Gas Cabinet Series

SurePurge™ 1500 – Two Cylinder Cabinet

Standard Features on *UltraPurge* and *SurePurge* Gas Cabinets

- Both models feature Z-purge for NEC Class 1, Division 2 rated locations
- Dual cabinet outlets
- Auto-switchover configuration for continuous gas service
- Exhaust flow monitor
- *UltraPurge* models
  - PLC controller for reliable service
  - One controller per process panel provides reliability
  - Over 10,000 units in service worldwide
  - Easy-to-use operator interface
- *SurePurge* models
  - PLC platform
  - Open communication protocol through ethernet
  - *SurePurge* 100 model replaces UP100 series
  - *SurePurge* 1000 model
    - Readily available PLC with color touch screen reduces cost
    - Replaces *UltraPurge* for upgrade applications
  - *SurePurge* 1500 model
    - PLC with color touch screen operator interface
    - Offers maximum control with user customization and a wide variety of configurable input and output options

System Options

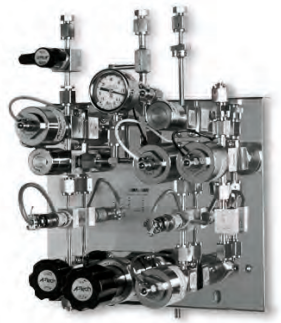
- Automatic cylinder switchover for continuous gas flow
- Cylinder shelves available
- Autoswitch with dual cabinet
- Coaxial process outlet with monitoring to accommodate double containment piping
- Light tower for cabinet status
- Gas management systems ready on all models

Please consult your local Praxair representative for a wide range of options when ordering Semiconductor Gas Cabinets, Panels and Controllers. We're here to help!

Gas Delivery Systems

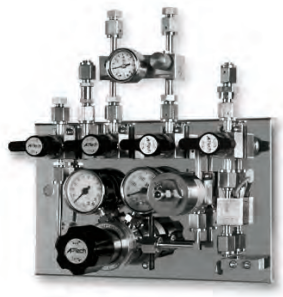
Semiconductor Gas Cabinets, Panels and Controllers

Process Panels*



UP6 Process Panel

UP2 Manual Purge Panel



WP5M Manual Process Panel for Hazardous Gas Service

Reliable

- Fully automatic switchover capability for uninterrupted gas flow
- Industry standard UHP components
- Leak tested and certified to maximize system integrity

Easy to Use

- Single plane design with removable manifolds for easy maintenance

Safe Operation

- Vent system with integral venturi valve assures efficient purging
- Mirror-finish stainless steel backplate facilitates component inspection
- Two-point fastened pigtails prevent transmission of torque to VCR® connection
- Positive flow of purge gas out of pigtails while changing cylinders helps prevent atmospheric contamination
- Fully swept flow paths
- Continuous vent bleed system allows nitrogen flow to discharge from the system during power failure
- Engineered to improve purge efficiency and reduce entrapment areas
- All pneumatic valves are closed during power loss or pneumatic failure

Other valve manifold configurations are available upon request.

Automatic System Controllers

***SurePurge™ 100* PLC Controller**

Used to control PRS6 Panel

- Enhanced safety and security through four level password protocol
- One of the smallest Programmable Logic Controllers (PLC) on the market
- Plug and play replacement model for the *UP100 UltraPurge™*
- Program an automatic purge routine
- Advanced communication options allow remote monitoring of your cabinet

***SurePurge™ 8100* System Monitor**

System monitoring device for gas cabinets

- Features plug in replacement for SM8100/EES series controllers
- Reliable PLC platform
- Touch screen interface
- Configurable for one or two semiautomatic panels
- Scale inputs built in
- User Configurable Alarms
- Main screen shown

***SurePurge™* AWS 100 Auto Switchover**

Required to perform auto-switching

- Features plug in replacement for ASW100 series controllers
- Reliable PLC platform
- Touch screen interface
- Configurable for one or two semiautomatic panels
- Scale inputs built in
- User Configurable Alarms
- Main screen shown

Let our trained experts help you select a configuration based on your specific needs, contact your local Praxair representative for more information.

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Valve Manifold Box

Valve Manifold Boxes (VMB) are designed to safely split a single Hazardous or Non-Hazardous gas supply into multiple use points. This concept increases efficiency in the manufacturing or research area by reducing the required space necessary to supply multiple locations. Distribution Valve Boxes (DVB) are designed with larger components to supply high volumes of gas.

Standard Designs

- **Manual –** Functions are operator controlled for cost efficiency
- **Semiautomatic –** Provides a safety shutoff controlled by customer selected inputs such as leak detection or low exhaust flow
- **Automatic –** Provides ultra safe operation by preventing valves from opening incorrectly. Also allows for fully automatic purging and gas on/off operation from the manufacturing tool

Panel Configurations

VMB's are available with modular outputs from 1-4 and 1-8 sticks. This concept allows for cost efficient expansion as the customers facility grows. When selecting a configuration first decide what the total future amount of sticks will be and install either a 4 or 8 stick enclosure. Then specify from 1-4 or 4-8 sticks.

Standard Features

- 11 Gauge steel construction with powder coat finish
- Self closing and locking door with access port
- Wall mount
- PLC controller (Semi-automatic and automatic models) with color touch screen operator panel
  - Color Touchscreen Operator Interface
  - 4 level security prevents unauthorized access
  - User configurable alarms

Typical Stick configuration

- Dual isolation valves
- Regulator with gauge or transducer
- Excess Flow Switch
- Purge and vent valves

Optional Stick components

- Coaxial outlet with or without monitoring
- Weld port for ease of process line installation

System Options

- Floor Mount Leg kit
- Leak Detection
- UV/IR Flame Detection

Please consult your local Praxair representative for a wide range of options when ordering. We're here to help!

Gas Delivery Systems

Bulk Gas Delivery Systems

SureFlow™ Bulk Specialty Gas Supply Systems and Controllers

Praxair is revolutionizing flow rates for ammonia as well as many other specialty gases. Our systems significantly reduce the number of cylinder changeouts required by conventional systems – helping customers achieve improvements in uptime, production costs, more consistent purity, and most importantly, safety.

The proprietary Praxair enclosed heating system and new silicone rubber heat blanket system allow for higher flow rates while maintaining controlled external ton container temperatures. These systems can be skid mounted to facilitate installation and movement around the facility. They deliver continuous ammonia flows of 600 slpm with peaks greater than 3000 slpm.

SureFlow™ 500
Regulator Manifolds

Gases

- Ammonia (NH_3)
- Chlorine (Cl_2)
- Dichlorosilane (SiH_2Cl_2)
- Hydrogen Chloride (HCl)
- Halocarbon 14 (CF_4)
- Halocarbon 23 (CHF_3)
- Halocarbon 116 (C_2F_6)
- Halocarbon 218 (C_3F_8)
- Halocarbon 318 (C_4F_8)
- Methane (CH_4)
- Nitrous Oxide (N_2O)
- Nitrogen Trifluoride (NF_3)
- Octafluorotetrahydrofuran (C_4F_8O)
- Silane (SiH_4)
- Silicon Tetrachloride ($SiCl_4$)
- Trichlorosilane ($HSiCl_3$)

Reliable, Easy-to-Use and Safe to Operate

- Self contained purge system
- Failsafe normally closed valves
- Data acquisition or remote monitoring PC interface on controller
- Redundant supply trains
- Auto switchover based on weight or pressure
- Bypass valving allows cross utilization of gas and components
- Excess flow switch
- Train isolation allows service on one train while the other remains in service
- Ventilated enclosures – air intake filters and diffuser for continuous, positive ventilation
- Double block valves for safe maintanance
- All components are 3000 psig rated
- Optional, redundant controller provides optimum service

Designed for High Purity

- Components and piping are UHP electropolished 316L Stainless Steel with an internal finish of less than 10 Ra Max
- Low dead space components and tubing branches for efficient purging
- Pressure transducers with low dead space
- Minimized wetted surface area of components
- Springless, packless diaphragm valves
- All welds are high-purity orbital welds
- All manual connections are VCR type
- Leak tight and tested to 1 x 10^{-9} scc/sec He

Controller

- Component burn-in prior to shipment
- Liquid crystal display TFT touchscreen
- Full graphical interface
- Emergency shutoff button on front
- All valve actuations are verified
- Critical alarms close all valves
- AC/DC power failure detection
- Ethernet communication ready
- Optional fiber optic RS-485
- Digital I/O optically isolated to prevent solenoid EM field from disrupting microprocessor
- Menu driven operation

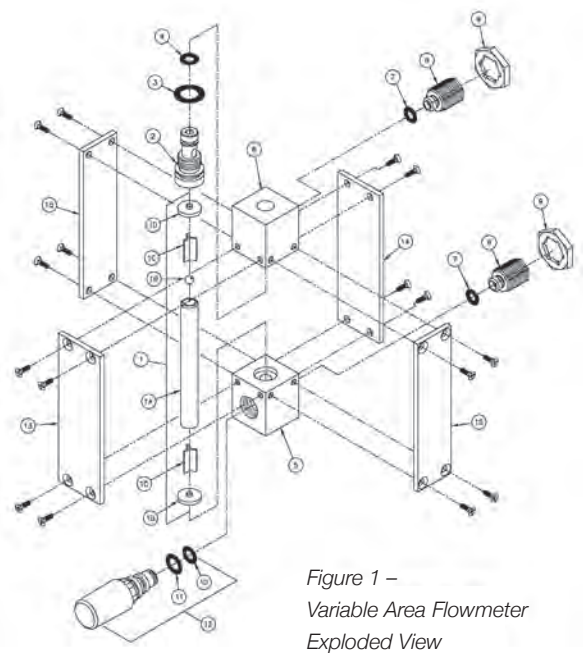
Heating System

- Automatic shutoff with dual set points
- Safety critical alarms shut off flow
- Infrared temperature monitoring of ton container surface (enclosed heat system)
- Enclosed heat system is fully insulated and weather resistant

▲ *Enclosed heating system (left) and silicone rubber heat system (right)*

◀ *BSGS Redundant PLC Controller*

Let our trained experts help you select a configuration based on your specific application, contact your local Praxair representative for more information.



1 Metering Tube Assembly
1A Metering Tube
1B Float
1C Float Stops
1D Tube Seat Packing
2 Seal Spindle
3 Seal Spindle O-ring (Large)
4 Seal Spindle O-ring (Small)
5 Inlet End Block
6 Outlet End Block
7 Adapter O-ring
8 Inlet and Outlet Adapter
9 Locknut
10 Metering Valve Assembly O-ring (Small)
11 Metering Valve Assembly O-ring (Large)
12 Metering Valve Assembly
13 Window Shield
14 Back Shield
15 Side Plate

Figure 1 – Variable Area Flowmeter Exploded View

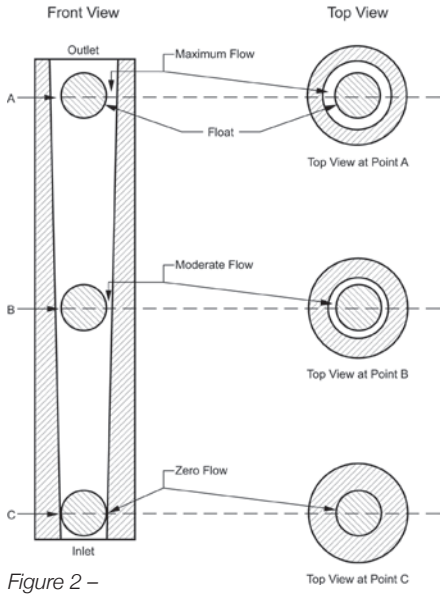


Figure 2 – Variable Area Flowmeter Principle of Operation

A variable area flowmeter *(Figure 1)* is a device used for measuring the flow of gases or gas mixtures. Typically, it consists of a glass metering tube **(1A)** which is internally tapered such that the inside diameter at the bottom of the tube is smaller than at the top. A float or floats **(1B)** placed inside the tube is/are contained by float stops **(1C)** inserted into the inlet and outlet of the tube. The metering tube assembly **(1)**, consisting of the glass metering tube, float(s), float stops and tube seat packing **(1D)**, is fitted between the inlet end block **(5)** and outlet end block **(6)** and sealed by the tube seat packing. The flowmeter is held together by a window shield **(13)**, a back shield **(14)** and side plates **(15)**. Once assembled, the metering tube is tightened against the tube seat packing via the seal spindle **(2)** to ensure leak-free operation. Flowmeters may also be equipped with a metering valve **(12)** which adds the capability of controlling flow rate.

As gas enters the flowmeter tube, the float is lifted from the zero position at the bottom of the tube. The float *(Figure 2)* rises to a point where the area surrounding the float is sufficient to allow unrestricted flow of gas. The greater the flow of gas, the higher the float will rise. By knowing the variables involved (service gas, pressure, temperature, weight of float, tube diameter, etc.), the height of the float can be directly correlated to the flow of gas with relatively good accuracy. Generally, the tube is inscribed with a scale allowing the user to read the float position. The scale may be direct reading in flow units such as standard liters per minute (slpm) or standard cubic feet per hour (scfh). It may also be in a linear measurement such as millimeters (mm) which would require a calibration chart for cross referencing the linear measurement to a corresponding flow rate.

The accuracy of a variable area flowmeter is contingent on both its operating pressure and temperature. Gases at higher pressures will be compressed, and therefore a greater volume of gas will pass through the same given area. Similarly, gases at higher temperatures will be less dense, and less gas will pass through a given area.

Therefore, all variable area flowmeters are calibrated at specific temperature and pressure conditions – generally at normal temperature (70 °F) and pressure (14.7 psia).

In selecting a flowmeter, the following items should be taken into consideration:

1. Materials Compatibility – As with all gas handling equipment, care must be taken to ensure that the materials used to construct the flowmeter are compatible with the service gas. Each of the flowmeters shown in this catalog is provided with a list of its materials of construction.

2. Pressure and Temperature Ratings – The flowmeter must be capable of handling pressures and temperatures required by the particular application. Maximum operating pressures and temperatures are provided for each flowmeter under “Specifications.”

3. Measuring Range – Flowmeters have specific measuring ranges associated with them. These ranges will vary depending on the flowmeter model as well as the tube and float combination selected. Obviously, the specific flowmeter chosen must be capable of measuring in the flow range required by the process. In general, for the best accuracy, it is suggested that the flometer be sized for operation in the upper part of its range.

4. Accuracy – The flowmeter should be accurate to the degree required by the application. Accuracy specifications are listed for each of our flowmeters. Generally, this will be ± 5% or ± 10% of full scale.

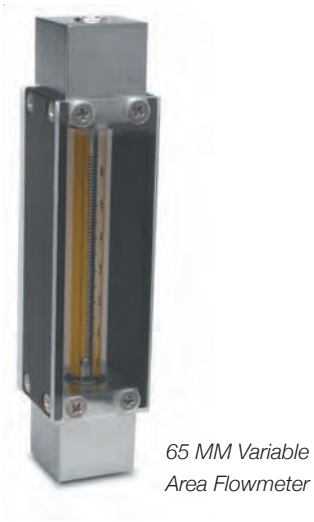
Full scale accuracy means that the accuracy specification is based on the flowmeter’s maximum capacity. For example, a meter with a measuring range of 1-10 slpm and an accuracy specification of ± 10% will have an actual accuracy of ± 1 slpm across its entire range – that is, ± 10% of the maximum capacity of 10 slpm.

5. Repeatability– In many gas processes, the ability to duplicate flow measurements over time is more important than the absolute accuracy of the readings. The repeatability specification shown for each flowmeter refers to the degree to which a meter will repeat a previous flow reading. In general, variable area flowmeters have very good repeatability, many as high as ± 0.25% of full scale.

6. Metering Valves – Flowmeters only measure flow. If adjustments to flow rates are required, a flowmeter equipped with a metering valve should be selected.

65 MM, Variable Area Flowmeters (Series 65)

Series 50 flowmeters offer an economical means of measuring gas or liquid flow at low pressures where ± 10% accuracy is acceptable. They are suitable for plant and general laboratory applications. Approximate flow ranges for air and several other gases are listed in the Tube Selection table below.



65 MM Variable Area Flowmeter

Standard Features

- Interchangeability of control valve and metering tube assemblies without disconnecting from the process piping.
- Rib-guided metering tube for maximum float stability and accuracy.
- Ceramic scales, with contrasting background for easy viewing, fired on metering tube.
- Ten-to-one (10:1) rangeability.
- Metering tubes sealed by compression.
- Metering tube assemblies contain float stops to prevent float loss during tube assembly removal.

Optional Features

- High resolution control valve for precise flow control.
- Baseplate with leveling screws permits bench use.

Specifications

- **Scale**
  Length: 65 mm
  Type: Fused on metering tube with contrasting yellow background
  Graduations: 0-65 mm with calibration data
- **Capacities**
  Refer to Tube Selection Table
- **Maximum Operating Pressure and Temperature Ratings**
  200 psig at temperatures up to 200 °F
- **Performance**
  Accuracy: ± 10% full scale.
  Accuracy specified for 100% to 10% of scale reading (10 to 1 rangeability).
  Repeatability: ± 0.5% of full scale reading
- **Connections**
  1/8" female NPT threaded adapters with locknuts for front panel mounting
- **Approximate Weight**
  0.75 lb

Materials

- **Metering Tube**
  Borosilicate glass
- **Floats**
  Glass or 316 stainless steel
- **Float Stops**
  Teflon
- **Shields**
  Window: Clear polycarbonate
  Back: Opaque white polycarbonate
- **Tube Packing and O-rings**
  Viton® (optional materials available)
- **Structural Members**
  Side Plates: Black anodized aluminum
  End Fittings: Black anodized aluminum or 316 stainless steel
  Metering Valve: Black anodized aluminum (standard cartridge valve only), brass/nickel-plated brass (high resolution control valve only) or 316 stainless steel

Viton® –
DuPont Dow Elastomers L.L.C.

Tube Selection Table for Series 50 Flowmeters – Flow ranges shown are at 70° F and 14.7 PSIA

Tube Number	Float Material	Air	Argon	Carbon Dioxide	Helium	Hydrogen	Nitrogen	Oxygen
0	Glass	4.5-45 sccm	3.2-32 sccm	4.5-45 sccm	4.5-45 sccm	10-100 sccm	4.4-44 sccm	4.0-40 sccm
1	Glass	7.8-78 sccm	6.6-66 sccm	9.5-95 sccm	7.0-70 sccm	16-160 sccm	7.5-75 sccm	6.0-60 sccm
2	Glass	44.5-445 sccm	32.6-326 sccm	39-390 sccm	50-500 sccm	0.1-1.0 slpm	45-450 sccm	40-400 sccm
3	316 SS	94.8-948 sccm	68.2-682 sccm	76.4-764 sccm	98.1-981 sccm	0.19-1.93 slpm	83.9-839 sccm	76.6-766 sccm
4	Glass	0.22-2.19 slpm	0.16-1.6 slpm	0.18-1.76 slpm	0.27-2.70 slpm	0.66-6.60 slpm	0.22-2.23 slpm	0.19-1.90 slpm
5	316 SS	0.44-4.40 slpm	0.34-3.39 slpm	0.35-3.46 slpm	0.75-7.50 slpm	1.3-12.8 slpm	0.45-4.50 slpm	0.43-4.25 slpm
6	316 SS	0.85-8.49 slpm	0.65-6.50 slpm	0.72-7.23 slpm	1.7-17.3 slpm	2.6-25.8 slpm	0.84-8.40 slpm	0.80-8.00 slpm
7	316 SS	1.2-11.9 slpm	0.96-9.60 slpm	0.94-9.35 slpm	2.5-24.8 slpm	3.7-37.3 slpm	1.1-11.0 slpm	1.0-10.0 slpm
8	316 SS	2.0-20.0 slpm	1.6-15.7 slpm	1.6-15.6 slpm	4.3-43.1 slpm	6.5-64.9 slpm	2.0-20.0 slpm	1.7-17.1 slpm
9	316 SS	4.3-43.4 slpm	3.2-31.7 slpm	3.1-31.3 slpm	9.5-95.3 slpm	14-137 slpm	4.4-44.0 slpm	4.2-42.0 slpm

Flow capacities for gases not listed may be obtained by contacting your local representative.

Ordering Information

Equipment

Series	Part Number	End Blocks Material	Inlet/Outlet Adaptor Material
65	PRSFM4350-( )	Aluminum	Aluminum
65	PRSFM4360-( )	316 Stainless Steel (SS)	316 SS

Where "( )" is indicated above, complete the part number by inserting applicable tube number from the Tube Selection Table above.
Example: PRSFM4350-3

Additional Equipment

Item	Part Number
Baseplate	PRSFM4702

PRAXAIR
Making our planet more productive

150 MM, Variable Area Flowmeters (Series 150)

Series 150 flowmeters offer an accurate yet economical means of measuring gas or liquid flow at low pressures and over a wide range of flow rates. Suitable for both plant and laboratory use, they are widely used in gas chromatography, atomic absorption spectroscopy and process control.

150 mm, Variable Area Flowmeter

Standard Features

- Two (2) floats per tube expand range of flowmeter.
- Interchangeability of control valve and metering tube assemblies without disconnecting from the process piping.
- Rib-guided metering tube for improved float stability and accuracy.
- Ceramic scales, with contrasting background for easy viewing, fired on metering tube.
- Ten-to-one (10:1) rangeability.
- Metering tubes sealed by compression.
- Metering tube assemblies contain float stops to prevent float loss during tube assembly removal.
- Available with or without a control valve.

Optional Features

- Sapphire, carboloy or tantalum floats allow range of flowmeter to be changed without replacing the tube.
- Baseplate with leveling screws permits bench use.
- High resolution control valve for precise flow control.

Calibration

Standard (+ 5% accuracy) calibration is performed using Air at normal temperature (70 °F) and pressure (14.7 psia). Calibrations for gases other than air are mathematically derived from the air calibration. Calibration charts for air are shipped with each flowmeter or replacement tube. Calibration charts for many other gases and gas mixtures are available at no additional charge. Specify the required calibration charts when ordering. The accuracy of this calibration is +5% of full scale. All charts are supplied in metric flow metric flow increments (i.e. sccm or slpm) unless otherwise specified.

Specifications

- **Scale**
  Length: 150 mm
  Type: Fused on metering tube with contrasting yellow background
  Graduations: 0-150 mm with calibration data
- **Capacities**
  Refer to Tube Selection Table
- **Maximum Operating Pressure and Temperature Ratings**
  200 psig at temperatures up to 200 °F
- **Performance**
  Accuracy: ± 5% full scale. Accuracy specified for 100% to 10% of scale reading (10 to 1 rangeability)
  Repeatability: ± 0.25% of full scale reading
- **Connections**
  1/8" female NPT threaded adapters with locknuts for front panel mounting
- **Approximate Weight**
  1 lb

Materials

- **Metering Tube**
  Borosilicate glass
- **Floats**
  Glass and 316 stainless steel (standard). Sapphire, carboloy and tantalum optionally available – refer to Tube Selection Table (see page E•313) and Optional Equipment
- **Float Stops**
  Teflon
- **Structural Members**
  Side Plates: Black anodized aluminum
  End Fittings: Black anodized aluminum or 316 stainless steel
- **Structural Members (cont.)**
  Metering Valve:
  Black anodized aluminum (standard cartridge valve only), brass/nickel-plated brass (high resolution control valve only) or 316 stainless steel.
- **Shields**
  Window: Clear polycarbonate
  Back: Opaque white polycarbonate
- **Tube Packing and O-rings**
  Viton® (optional materials available)

  Viton® – DuPont Dow Elastomers, L.L.C.

Ordering Information

Single (1)-Tube Flowmeter Part Number	Configuration	End Blocks Material	Valve Assembly Materials	Inlet and Outlet Adapter Material
PRSFM4300-( )	Without Valve	Aluminum	Not Applicable	Aluminum
PRSFM4310-( )	Without Valve	316 SS	Not Applicable	316 SS
PRSFM4301-( )	With Standard Cartridge Valve	Aluminum	Aluminum	Aluminum
PRSFM4311-( )	With Standard Cartridge Valve	316 SS	316 SS	l316 SS
PRSFM4302-( )	With High Resolution Control Valve	Aluminum	Brass, nickel-plated brass and 316 stainless steel	Aluminum
PRSFM4312-( )	With High Resolution Control Valve	316 SS	316 SS	316 SS

Note:
Where ( ) is indicated "Single (1) – Tube Flowmeter Part Number", complete the part number by inserting applicable tube number from Tube Selection Table on page E•313.
Example: PRSFM4300-1. Order by complete part number.

Flow Devices

Tube Selection for 150 mm Flowmeters

Tube Selection Table for Series 150 Flowmeters

Maximum flow rates shown are at 70 °F and 14.7 PSIA. (Minimum flow rates = 1/10 of maximum flow rate)

Tube Number	Float Material	Air (slpm)	Argon (slpm)	Carbon Dioxide (slpm)	Helium (slpm)	Hydrogen (slpm)	Nitrogen (slpm)	Oxygen (slpm)	Water (cc/min)
1	Glass	.050	.042	.058	.047	.103	.052	.045	0.55
	Sapphire	.081	.065	.092	.077	.162	.084	.070	1.04
	316 SS	.150	.123	.160	.149	.323	.156	.135	2.50
	Carboloy	.263	.214	.268	.273	.606	.265	.235	5.30
	Tantalum	.300	.256	.280	.341	.726	.306	.281	6.60
2	Glass	.089	.077	.110	.091	.195	.095	.082	1.10
	Sapphire	.144	.116	.168	.143	.311	.145	.127	2.15
	316 SS	.278	.227	.298	.271	.580	.280	.245	4.90
	Carboloy	.473	.399	.480	.519	1.11	.485	.442	10.0
	Tantalum	.560	.466	.514	.632	1.32	.570	.520	12.0
3	Glass	.365	.300	.360	.390	.840	.380	.326	4.70
	Sapphire	.514	.440	.449	.620	1.30	.541	.488	10.0
	316 SS	.835	.714	.750	1.18	2.35	.860	.800	19.0
	Carboloy	1.25	1.05	1.10	2.16	3.84	1.29	1.18	36.0
	Tantalum	1.37	1.17	1.19	2.45	4.30	1.40	1.28	41.0
A	Glass	.850	.709	.755	1.50	2.65	.860	.786	16.0
	Sapphire	1.10	.942	.980	2.00	3.54	1.15	1.00	27.0
	316 SS	1.70	1.44	1.40	3.50	5.60	1.73	1.58	46.0
	Carboloy	2.43	2.00	2.14	5.10	8.10	2.40	2.32	73.0
	Tantalum	2.62	2.24	2.27	5.60	8.80	2.60	2.50	81.0
4	Glass	2.34	1.90	2.06	5.00	7.80	2.40	2.33	55.0
	Sapphire	3.08	2.63	2.69	6.70	10.3	3.12	2.90	79.0
	316 SS	4.64	3.80	4.00	10.3	15.5	4.70	4.36	132
	Carboloy	6.60	5.50	5.60	15.0	22.6	6.70	6.20	200
	Tantalum	7.00	6.00	6.07	16.0	23.7	7.10	6.60	214
B	Glass	3.80	3.20	3.40	8.20	12.8	3.90	3.55	87.0
	Sapphire	5.07	4.30	4.40	10.8	16.3	5.10	4.80	126
	316 SS	7.58	6.50	6.45	16.9	25.5	7.80	7.20	210
	Carboloy	10.8	9.40	9.12	24.5	38.1	11.1	10.6	330
	Tantalum	11.5	10.0	9.69	26.4	41.1	12.0	11.2	353
5	Glass	7.70	6.51	6.50	16.5	26.0	7.60	7.00	173
	Sapphire	9.64	8.26	8.30	21.8	33.5	10.0	9.19	260
	316 SS	14.3	12.2	12.0	31.2	47.0	15.2	13.3	420
	Carboloy	20.1	17.2	17.1	47.6	71.3	20.6	19.1	625
	Tantalum	22.0	18.5	18.0	51.0	76.2	22.4	20.9	680
6	Glass	23.3	20.0	19.9	55.6	82.4	23.7	22.4	550
	Sapphire	30.5	26.0	25.9	78.8	111	31.1	28.9	840
	316 SS	45.0	38.0	37.4	109	165	44.9	41.0	1332
	Carboloy	61.7	53.4	52.1	157	223	62.0	58.3	1956
	Tantalum	65.4	56.4	55.2	167	236	65.5	63.0	2160

Flow capacities for gases not listed may be obtained by contacting your local representative.

* Series 150 flow tubes are supplied standard with both a glass and 316 SS float.
Other float materials are optional. See Optional Equipment below.

Optional Float Materials

Description	Part Number
Sapphire Float – Tube Numbers 1,2,3,A,4,B	PRS-102-8-SP
Sapphire Float – Tube Numbers 5,6	PRS-102-3-SP
Carboloy Float – Tube Numbers 1,2,3,A,4,B	PRS-102-10-CB
Carboloy Float – Tube Numbers 5,6	PRS-102-5-CB
Tantalum Float – Tube Numbers 1,2,3,A,4,B	PRS-102-9-TA
Tantalum Float – Tube Numbers 5,6	PRS-102-4-TA

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150 MM, Two Tube Gas Blenders (Series 150)

This blender is a special version of our Series 150 flowmeter. It allows two gases to be metered and blended into a homogeneous, two-component mixture.

Two Tube Gas Blender with Optional Baseplate

Standard Features

- Two floats per tube (standard) expand range of blender.
- Ribbed flow tubes stabilize floats and improve accuracy and readability.
- Wide tube selection allows gases to be blended in a variety of ratios.
- Metal mixing tube ensures homogeneous mixing while providing a common outlet port for the gas mixture.
- Linear scale (10–150 mm) allows each blender to be used with a variety of gases via calibration charts.
- Threaded fittings with locking nuts permit front panel mounting.
- Unique valve design allows bubble-tight shutoff.

Optional Features

- Baseplate with leveling screws permits bench use.
- Inlet filters trap foreign matter, extend flowmeter life and reduce maintenance.
- High accuracy valves with non-rotating stems (NRS) allow very fine adjustments to flow settings (see Ordering Information below).
- Individual calibration provides ± 1% of full scale accuracy (±2% on tube No. 1).

Specifications

- **Maximum Operating Pressure and Temperature**
  200 psig at 250 °F
- **Minimum Operating Temperature**
  32 °F
- **Accuracy**
  ± 5% of full scale from 10% to 100% of range (each tube)
  Optional
  ± 1% of full scale calibration is available
- **Repeatability**
  Within 0.5% of full scale (each tube)
- **Tube Graduations**
  Millimeters (0–150)
- **Scale Length**
  150 mm
- **Inlet and Outlet Connections**
  1/8" FPT (2 inlets, 1 outlet)
- **Approximate Weight**
  2 lb

Materials

- **Tubes**
  Borosilicate Glass with float stops of Teflon®
- **Mixing Tube**
  Type 316 Stainless Steel
- **Floats**
  Borosilicate Glass and Type 316 Stainless Steel are standard. Other float materials are available – see Tube Selection Table (page E•313) and Optional Equipment, below
- **End Blocks**
  See Ordering Information
- **Inlet/Outlet Adaptors**
  See Ordering Information
- **Side Plates**
  Aluminum
- **Back Plate**
  White Plastic
- **Front Plate**
  Clear Plastic
- **Seals and Packing**
  Viton® (other materials available on special order)
- **Valves**
  Model FM4621:
  Chrome-Plated Brass
  All Others:
  Type 316 Stainless Steel

Ordering Information

Part Number	Configuration	End Blocks Material	Inlet/Outlet Adaptor Material
PRSFM-4620-( )	With Standard Metering Valves	Aluminum	Aluminum
PRSFM-4621-( )	With High Accuracy (NRS) Metering Valves	Aluminum	Aluminum
PRSFM-4630-( )	With Standard Metering Valves	316 Stainless Steel	316 Stainless Steel
PRSFM-4631-( )	With High Accuracy (NRS) Metering Valves	316 Stainless Steel	316 Stainless Steel

Where "( )" is indicated above, complete the part number by inserting the required tube numbers in the order in which they are to be installed. Select tubes from Tube Selection Table on page E•313.
Example: PRSFM4620-12, tube number 1 will be on the left and tube number 2 on the right.

Optional Equipment

Part Number	Description
PRSFM4702	Base plate
PRSFM4741	Inlet filter, 2 micron Aluminum (2 required)
PRSFM4746	Inlet filter, 2 micron Type 316 Stainless Steel (2 required)

* Tubes are supplied standard with borosilicate glass and stainless steel floats. As an option, the glass float may be replaced by sapphire; the stainless steel float may be replaced by either carboloy or tantalum.

Part Number	Description
See page E•313	Floats* (see Optional Equipment Table)

** Specify gas, temperature and pressure when ordering a ± 1% calibration. A calibration should be ordered for each of the two tubes. Please note the accuracy for tube No.1 is ± 2%.

Flow Devices

High Capacity Flowmeters

High Capacity, Variable Area Flowmeters (Series 50HC)

Series 50HC flowmeters offer a means of measuring gas or liquid flows at capacities higher than our other variable area flowmeters (up to 15 scfm air). They are suitable for both plant and laboratory use.

50HC Series Flowmeter

Standard Features

- Large diameter flow tubes permit flows as high as 15 standard cubic feet per minute (scfm) of air.
- Ribbed tubes stabilize float and improve accuracy and readability.
- Borosilicate glass tubes allow operating temperatures up to 200 °F.
- Brass or stainless steel construction permits use in either corrosive or noncorrosive gas service.

Specifications

- **Maximum Operating Pressure and Temperature**
  200 psig at 200 °F minimum operating
- **Minimum Operating Temperature**
  32 °F (0 °C)
- **Accuracy**
  ± 10% of full scale from 10% to 100% of range
- **Repeatability**
  Within 0.5% of full scale
- **Tube Graduations**
  scfm of air
- **Scale Length**
  75 mm
- **Inlet and Outlet Connections**
  3/8" FPT
- **Approximate Weight**
  2.5 lb

Materials

- **Tube**
  Borosilicate Glass
- **Float and Float Stops**
  Type 316 Stainless Steel
- **End Blocks**
  See Ordering Information
- **Inlet/Outlet Adaptors**
  See Ordering Information
- **Side Plates**
  Aluminum
- **Back Plate**
  White Plastic
- **Front Plate**
  Clear Plastic
- **Seals and Packing**
  Viton®
- **Metering Valve**
  Chrome-Plated Brass or 316 Stainless Steel

Table 1 – Gas Conversion Factors for Series 50HC Flowmeters

To select the proper tube for gases other than air, multiply flow rate values for air given in the Tube Selection Chart below by the applicable conversion factor. Then use these new flow rate values to select appropriate tube number. If you have questions contact your local Praxair representative.

Gas	Factor*	Gas	Factor*
Acetylene	1.04	Helium	2.69
Ammonia	1.30	Hydrogen	3.81
Argon	0.85	Methane	1.35
Butane	0.70	Neon	1.20
Carbon Dioxide	0.81	Nitrogen	1.01
Carbon Monoxide	1.01	Oxygen	0.95
Ethane	0.98	Propane	0.80
Ethylene	1.02	Sulfur Dioxide	0.66

* Conversion factors are approximately equal to square root of the reciprocal of the specific gravity of the gas ($\sqrt{1/SG}$).

Ordering Information

Series 50HC Flowmeters

Part Number	Metering Valve, End Blocks and Inlet/Outlet Adaptor Material
PRSFM4470-( )	Chrome-Plated Brass
PRSFM4480-( )	Type 316 Stainless Steel

Where "( )" is indicated above, complete the part number by inserting applicable tube number from the Tube Selection Chart to the right. Example: PRSFM4470-1 which has a flow range of 0.6 to 3.4 scfm. Order by complete part number.

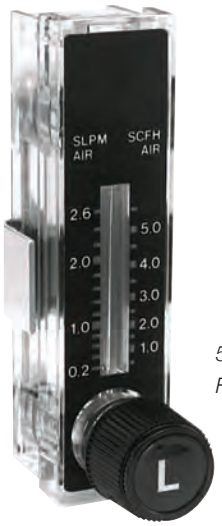
Tube Selection Chart for Series 50HC Flowmeters

Replacement Part Number	Tube Number	Tubes Air Flow Rate Range at 70 °F and 14.7 psia
PRSFM4471	1	0.6–3.4 scfm
PRSFM4472	2	0.6–6.0 scfm
PRSFM4473	3	1.2–12.0 scfm
PRSFM4474	4	2.0–20.0 scfm

Plastic, Variable Area Flowmeters (Series 50PM)

Series 50PM flowmeters provide an economical means for low flow measurement and control of noncorrosive liquids and gases.

Warning: This flowmeter is constructed of polycarbonate plastic. Make certain the gas you are using is compatible with the materials of construction. Injury to personnel or damage to equipment may result.



50PM Series Flowmeter

Standard Features

- Ribbed tubes stabilize float and improve accuracy and readability.
- Large numbers and gradations enhance readability.
- Available in either standard liters per minute (slpm) scale or standard cubic feet per hour (scfh).
- Unique valve design allows bubble-tight shutoff.
- Integral bezel and threaded mounting screw permits either flush or front panel mounting.
- Metal connection inserts prevent damage from overtightening fittings.

Specifications

- **Maximum Operating Pressure and Temperature**
  100 psig at 130 °F
- **Minimum Operating Temperature**
  32 °F
- **Accuracy**
  ± 10% of full scale from 10% to 100% of range
- **Repeatability**
  Within 1% of full scale
- **Tube Graduations**
  Standard liters per minute (slpm) and standard cubic feet per hour (scfh) of air
- **Scale Length**
  37 mm
- **Inlet and Outlet Connections**
  1/8" FPT
- **Approximate Weight**
  0.25 lb.

Materials

- **Body and Tube**
  Polycarbonate Plastic
- **Float**
  See Ordering Information
- **Connection Fittings and Valve**
  Brass
- **Seals**
  Viton®

Ordering Information

	Air Flow Rate Range at 70 °F and 14.7 psia Actual Graduations	
Part Number	**scfh**	**slpm**
PRSFM4491	–	0.1-1.2
PRSFM4492	–	0.2-2.4
PRSFM4493	–	0.5-6.0
PRSFM4494	–	1.0-12.0
PRSFM4495	–	2.5-30.0
PRSFM4496	–	10.0-55.0
PRSFM4497	0.2-2.6	–
PRSFM4498	0.5-5.0	–
PRSFM4499	1.0-14.0	–
PRSFM4500	2.0-26.0	–
PRSFM4501	5.0-60.0	–
PRSFM4502	20.0-120.0	–

High Pressure, Metal Tube, Variable Area Flowmeters (FM4460N Series)

These flowmeters offer economical low flow rate indication in applications where glass tube meters are not practical because of high pressure, high temperature or hazardous fluids.

Standard Features

- 316L stainless steel metal flow tubes allow operation up to 1500 psig.
- Type 316L stainless steel and Viton® construction provides excellent corrosion resistance.
- Unique valve design allows bubble-tight shutoff.
- Threaded holes on rear of flowmeter permit front panel mounting.

Optional Features

- Inlet filter traps foreign matter, extends flowmeter life and reduces maintenance.

Specifications

- **Maximum Operating Pressure and Temperature**
  1500 psig at 400 °F
- **Accuracy**
  ± 5% of full scale from 10% to 100% of range
- **Repeatability**
  Within 1% of full scale
- **Tube Graduations**
  Standard liters per minute (slpm) of air
- **Scale Length**
  55 mm
- **Inlet and Outlet Connections**
  1/4" NPT female
- **Approximate Weight**
  2 lb

FM4460N Series Flowmeter

Materials

- **Tubes, Fittings, Clean-Out Plug and Float Stop**
  Type 316L Stainless Steel
- **Housing**
  Epoxy Painted Aluminum
- **Float**
  Type 316 Stainless Steel
- **Float Stop Spring**
  Inconel® 625
- **Seals**
  Viton®
- **Valve**
  Type 316L Stainless Steel

Ordering Information

	Air Flow Rate Range at 70 °F and 14.7 psia	
Part Number	**Actual Graduations (slpm)**	**Reference (scfh)**
PRSFM4460N	0.1-1.0	0.2-2.2
PRSFM4461N	0.2-2.3	0.5-5.0
PRSFM4462N	0.6-6.0	1.3-13
PRSFM4463N	1.1-11	2.4-24
PRSFM4464N	2.6-26	5.5-55
PRSFM4465N	5.6-56	12-120

Mass Flow Measuring, Controlling and Blending Systems

Using state-of-the-art measuring and microprocessor technologies, Praxair has assembled a series of systems which can measure the mass flow rate of gas streams; measure and control mass flow rate; or perform gas blending operations – all with extremely high accuracy. These systems consist of an Operator Console that is electronically coupled to one or more Mass Flow Sensors and/or Mass Flow Control Modules.

Mass Flow Sensors

Mass Flow Sensors measure gas flow with a (+/-1% full scale accuracy, 1.5% full scale accuracy above 500 slpm). Since they do not control gas flow, Mass Flow Sensors are only used in applications requiring flow measurement. Capable of working with any of our Operator Consoles, Mass Flow Sensors are available for measuring flow rates in ranges as low as 0.1-5 sccm to ranges as high as 20-1000 slpm. For complete specifications on flow sensors, see pages E•319 and E•320.

Mass Flow Control Modules

Mass Flow Control Modules measure flow using the same principles as our Mass Flow Sensors. However, they also feature an integral electromagnetic control valve that gives them the ability to control gas flow with a (+/1% full scale accuracy, 1.5% full scale accuracy above 500 slpm). Based on this control capability, they can also be used to perform gas blending operations.

Available in two different models, all Mass Flow Control Modules are capable of working with our CM4 Operator Consoles.

1. Model FRC, Fast Response Control Modules, are offered in ranges from 0.1-5 sccm through 20-1000 slpm.
2. Model HPC, High Pressure Control Modules, can operate at inlet pressures as high as 3000 psig. They are available for flow ranges from 2-100 sccm up to 0.4-20 slpm.

For complete specifications on Control Modules, see pages E•321.

Operator Consoles

Praxair's Instrument Interface Module the CM4 is designed for use with all Praxair Instrument Series 100 and 200 Mass Flowmeters (MFM's) and Mass Flow Controllers (MFC's).

Model CM4 includes four input channels and has a setpoint control for each channel. Process flow rates for all channels are displayed on a large, bright, red digital panel meter as a percentage of full scale (F.S.). The range of this meter is from 000.0 to 102.4 percent. Setpoints for any channel may also be displayed on the panel meter in the same percentage of full scale flow units. Setpoints are adjustable to any value in the previously stated range using the 10-turn adjustment controls.

Control action occurs when the process flow value in a given channel matches its respective setpoint. Both instruments also feature Automatic Proportional Tracking (APT) Mode operation. APT operation permits setting the flow rate control in one or more channels to be a fixed ratio of the flow rate control in a reference channel, regardless of the process flow rate in that reference channel.

Interconnecting Cables

Interconnecting cables are used in all systems for coupling the Flow Sensors and Control Modules to the operator console. One 10 foot cable is provided with each Sensor or Control Module purchased, with these cables, the Operator Console can be remotely located away from the sensors and control modules. This enhances the operator's safety – especially when working with toxic or otherwise hazardous gases.

Materials of Construction

All wetted parts of these systems (parts in contact with the gas) are of stainless steel construction with Viton® used as a sealing material. Other seal materials (Buna-N®, EPDM, Neoprene or Kalrez®) are available on special order, allowing these systems to be used in nearly any gas service.

Selecting Mass Flow Measuring and Control Systems

1. Review the Operator Console features on page E•321.
2. Review the specifications on page E•323 and determine the type of flow control or sensing devices required for your operation. Then select the appropriate model number.
   Note: As previously discussed, Mass Flow Control Modules are used where both measurement and control are desired, or for gas blending applications. Mass Flow Sensors are used in applications requiring flow measurement only.
3. Review the applicable selection guide on page E•323 and choose the flow range(s) required for your operation.

Selecting Gas Blending Systems

1. Review the Operator Console features on page E•321 and select the console for your needs. As shown in Table 1, the choices for blending applications are limited to the CM4.
2. Select the appropriate range for each Mass Flow Control Module. This can be done by determining the total mixture flow required and multiplying this by the percentage composition that each component represents in the mixture. Then compare this to the flow ranges available on page E•323.
3. Review the specifications on page E•323 and select the model number

Note: In blending systems, the outlets of flow control modules must be manifolded together to create the blend. Therefore to prevent the possibility of back-flow from one module to another, it is strongly recommended that you select proper check valves and install them at the outlet of each module. See page E•379 for check valves. If you have questions contact your Praxair representative.

Flow Devices

Mass Flowmeters and Controllers

Fast Response Module, Models 1FRC-14FRC

Fast Response Module, Models 15FRC - 17FRC

Fast Response Module, Model 18FRC

Fast Response Module, Model 19FRC

Mass Flow Control Module Specifications

	Fast Response Module, Models 1FRC - 14FRC	Fast Response Module, Models 15FRC - 17FRC	Fast Response Module, Model 18FRC	Fast Response Module, Model 19FRC
Maximum Operating Pressure	1000 psig	1000 psig	1000 psig	200 psig
Ambient and Operating Temperature Range	-10 to 70 °C (+14 to 158 °F)	-10 to 70 °C (+14 to 158 °F)	-10 to 70 °C (+14 to 158 °F)	-10 to 70 °C (+14 to 158 °F)
Maximum Flow Capacity	See page E•323	See page E•323	See page E•323	See page E•323
Rangeability (Accuracy) Control Range	50:1 (2% to 100% full scale)	50:1 (2% to 100% full scale)	50:1 (2% to 100% full scale)	50:1 (2% to 100% full scale)
Accuracy and Linearity	± 1% full scale	± 1% full scale	± 1% full scale	± 1% full scale
Repeatability	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range
Response Time	1 to 2 seconds	1 to 2 seconds	1 to 2 seconds	1 to 2 seconds
Minimum Pressure Drop[1]	5 PSID (7 PSID for Model 14FRC)	10 PSID (Model 15FRC) 15 PSID (Model 16FRC) 20 PSID (Model 17FRC)	30 PSID	10 PSID
Mounting Attitude Sensitivity	Attitude Insensitive	Attitude Insensitive	Attitude Insensitive	Attitude Insensitive
Inlet and Outlet Process Connections	1/4" Compression[2]	1/4" Compression[2]	3/8" Compression[2]	3/8" Compression[2]
Dimensions (inches) H x W x L	4.52 x 1.00 x 5.03[3]	4.90 x 1.00 x 5.03[3]	5.15 x 1.75 x 6.48[3]	5.27 x 1.88 x 7.38[3]
Weight (approximate)	1.5 lb.	1.5 lb.	4.5 lb.	5.5 lb.
Electrical Connection	Nine (9)-pin D-connector	Nine (9)-pin D-connector	Nine (9)-pin D-connector	Nine (9)-pin D-connector
Power Requirements (Current Consumption < 250 mAdc)	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc
Warm-up Time	10 minutes	10 minutes	10 minutes	10 minutes
Flow Output Signal	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)
Command (Setpoint) Signal	0-5 Vdc	0-5 Vdc	0-5 Vdc	0-5 Vdc

[1] Consult factory for correct sizing when operating parameters are questionable.
[2] Dimensions include Compression process connections.
[3] VCR connections are available on special order.

Mass Flow Control Module Specifications, (cont.)

	Fast Response Modules, Models 20FRC - 23FRC	Fast Response Modules, Model 24FRC	High Pressure Modules, Models 6HPC - 14HPC	High Pressure Modules, Models 15HPC and 16HPC
Maximum Operating Pressure	200 psig	200 psig	3000 psig	3000 psig
Ambient and Operating Temperature Range	-10 to 70 °C (+14 to 158 °F)	-10 to 70 °C (+14 to 158 °F)	-10 to 70 °C (+14 to 158 °F)	-10 to 70 °C (+14 to 158 °F)
Maximum Flow Capacity	See page E•323	See page E•323	See page E•323	See page E•323
Rangeability (Accuracy) Control Range	50:1 (2% - 100% full scale)	50:1 (2% - 100% full scale)	50:1 (2% - 100% full scale)	50:1 (2% - 100% full scale)
Accuracy and Linearity	± 1% full scale	± 1.5% full scale	± 1% full scale	± 1% full scale
Repeatability	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range
Response Time	1 to 2 seconds	1 to 2 seconds	1 to 2 seconds	1 to 2 seconds
Minimum Pressure Drop[1]	15 PSID (Model 20FRC) 20 PSID (Model 21FRC) 30 PSID (Model 22FRC) 35 PSID (model 23FRC)	80 PSID	Consult factory	Consult factory
Mounting Attitude Sensitivity	Attitude Insensitive	Attitude Insensitive	Attitude Insensitive	Attitude Insensitive
Inlet and Outlet Process Connections	1/2" Compression[2]	3/4" Compression[2]	1/4" Compression[2]	1/4" Compression[2]
Dimensions (inches) H x W x L	5.90 x 2.50 x 8.72[3]	5.90 x 2.50 x 9.04[3]	5.15 x 1.75 x 6.04[3]	5.15 x 1.75 x 6.36[3]
Weight (approximate)	11 lb	11 lb	4.5 lb	4.5 lb
Electrical Connection	Nine (9)-pin D-connector	Nine (9)-pin D-connector	Nine (9)-pin D-connector	Nine (9)-pin D-connector
Power Requirements (Current Consumption < 200 mAdc)	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc
Warm-up Time	10 minutes	10 minutes	10 minutes	10 minutes
Flow Output Signal	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)
Command (Setpoint) Signal	0-5 Vdc	0-5 Vdc	0-5 Vdc	0-5 Vdc

[1] Consult factory for correct sizing when operating parameters are questionable.
[2] Dimensions include Compression process connections.
[3] VCR connections are available on special order.

Model CM-400 Operator Console
4 Channel Power Supply and Control Module

The CM-400 is a high performance microprocessor based 4-channel power supply/ control module designed for use with *ProSpec*™ Mass Flow Meters and Controllers. An 8-line, backlit LCD display provides selectable data on the status of the 4 channels simultaneously; low noise, thermal overload protected +15 Vdc device power is provided on each channel. The CM-400 accepts user selectable current or voltage input signals and supplies a selectable set point signal for each channel. In addition to the analog I/O, a digital communication port is included for computer/PLC interface. A programmable multichannel blend control and totalizer with batch function allows the CM-400 to precisely interact with *ProSpec* Platinum MFCs in a versatile and functional gas management system.

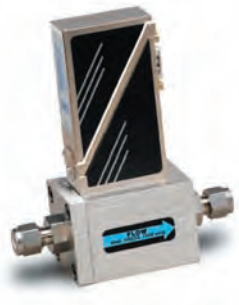
Specifications

- **Programmable Control and Measurement Functions**
  - Channels – Four independent channels
  - Rate, Batch, Blend, Measure 0.000 to 999999
  - Blend Ratio Percent 0.000 to 999.999
  - Totalizer 0.000 to 19,999,999,999
  - Gas Correction Factor 0.000 to 999.999
  - Input and Output Signal Selection – Volts or mA, independent, mix or match
  - Input and Output Full ScaleSetting Independent, 0.000 to 999,999
  - Setpoint Source – Keypad or RS232
- **Keypad/Display Window**
  8-Key Metal Dome Tactile with Selectable Audio Beep
  - Construction Splash proof and chemically resistant
  - Hot Keys for Instant Access – Setpoint (rate, batch, blend), VOR
  - System Power – Key selectable power down, power up
- **Environment**
  - Temperature/Humidity
    Operating:
    32 to 122 °F (0 to 50 °C);
    0 to 95% non-condensing
    Ship/Storage:
    -40 to 185 °F (-40 to 85°C);
    0 to 95% non-condensing
  - Warm-up 15 min typ to rated accuracy
  - Data Reliability
    Data Retention:
    Non-volatile RAM/ROM, 100 year retention
    Self-Diagnostics:
    On power up, memory checksum, communications, system status, display and keypad operation
  - Enclosure:
    Material: ABS Cycolac Resin FR23
    Weight: 1.4 lbs (635 g)
- **Electrical**

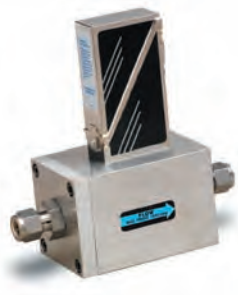
  Input Electrical Characteristics
  - Voltage Input, 0-5, 0-10, 1-5, 2-10 V
  - Volts Input Impedance 10 K Ohms
  - Current Input 0-20, 4-20 mA
  - Current Input Impedance 100 Ohms

  Output Electrical Characteristics
  - Voltage Output 0-5, 0-10, 1-5, 2-10 V
  - Voltage Output Load 2 K Ohms minimum
  - Current Output 0-20, 4-20 mA
  - Current Output Load 0-375 Ohms
  - Power Supply Output +15 Vdc, 1.4A
- **Channel Connectors (4)**
  - 15-pin female D: Provides signal and power to connected devices
- **Serial Port**
  - EIA-TIA232D full duplex D9S Load 4.7 K max
- **Communications**
  - Full communications capability for remote readout setpoint, control, programming, and data acquisition
- **Power Supply Requirements**
  - Required Input 100–240 Vac, 47–63 Hz
  - Instrument Power Draw 0.8 W
- **Graphic Display**
  - 8-line x 40-character LCD display with backlight
- **Programmable Display Configuration**
  - Two lines per channel
  - Line 1, Process Variable: Rate, Total, or Signal
  - Line 2, Setpoint: Rate, Batch, Blend, or Signal Off: Unused individual lines can be turned off
- **Certifications**
  - CE Mark EN61326-1 and EN61010-1
  - FCC Part 15 Class A, Part 68
  - RoHS EPD 2002/95/EC, 01Jul2006
  - UL UL 61010 Electrical Safety for General Purpose Indoor Use
- **Mounting Options**
  - Table Top Kit (included)
  - Panel Mount Kit

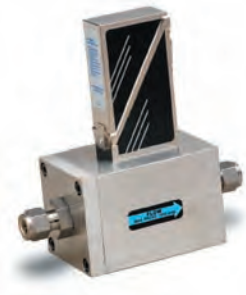
Fast Response
Mass Flow Sensor
Models 1FRM-14FRM



Fast Response
Mass Flow Sensor
Models 15FRM-19FRM



Fast Response
Mass Flow Sensor
Models 20FRM-23FRM



Fast Response
Mass Flow Sensor
Model 24FRM

Mass Flow Sensor Specifications

	Fast Response Mass Flow Sensor Models 1FRM-14FRM	**Fast Response Mass Flow Sensor Models 15FRM-19FRM**	**Fast Response Mass Flow Sensor Models 20FRM-23FRM**	**Fast Response Mass Flow Sensor Models 24FRM**
Maximum Operating Pressure	1500 psig	1500 psig	1500 psig	1500 psig
Ambient and Operating Temperature Range	-10 to 70 °C (14 to 158 °F)	-10 to 70 °C (14 to 158 °F)	-10 to 70 °C (14 to 158 °F)	-10 to 70 °C (14 to 158 °F)
Maximum Flow Capacity	See page E•323	See page E•323	See page E•323	See page E•323
Rangeability (Accuracy)	50:1 (2% - 100% full scale)	50:1 (2% - 100% full scale)	50:1 (2% - 100% full scale)	50:1 (2% - 100% full scale)
Accuracy and Linearity	± 1% full scale	± 1% full scale	± 1% full scale	± 1.5% full scale
Repeatability	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range	± 0.2% full scale at any constant temperature within operating temperature range
Response Time	1 to 2 seconds	1 to 2 seconds	1 to 2 seconds	1 to 2 seconds
Pressure Drop	< 1 PSID	< 1 PSID	< 1 PSID	< 1 PSID
Mounting Attitude Sensitivity	Attitude Insensitive	Attitude Insensitive	Attitude Insensitive	Attitude Insensitive
Inlet and Outlet Process Connections	1/4" Compression[1]	1/4" Compression[1] (Models 15FRM - 17FRM) 3/8" Compression[1] (Models 18FRM and 19FRM)	1/2" Compression[1]	3/4" Compression[1]
Dimensions (inches) H x W x L	4.52 x 1.00 x 4.21[2]	5.15 x 1.75 x 4.58[2] (Models 15FRM - 17FRM) 5.15 x 1.75 x 4.70[2] (Models 18FRM and 19FRM)	5.90 x 2.50 x 6.16[2]	5.90 x 2.50 x 7.91[2]
Weight (approximate)	1 lb.	2.5 lb.	5.5 lb.	6 lb.
Electrical Connection	Nine (9)-pin D-connector	Nine (9)-pin D-connector	Nine (9)-pin D-connector	Nine (9)-pin D-connector
Power Requirements (Current Consumption < 45 mAdc)	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc	+12 (± 5%) or +15 (± 10%) Vdc
Warm-up Time	10 minutes	10 minutes	10 minutes	10 minutes
Flow Output Signal	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)	0-5 Vdc (2K ohm minimum load resistance)

[1] VCR connections are available on special order.
[2] Dimensions include Compression process connections.

Mass Flow Control Modules and Sensors Selection Guide

Model Numbers			Maximum Flow Capacity (Minimum Capacity = 2% of Maximum) for a Partial Reference of Gases			
Fast Response Control Modules	**High Pressure Control Modules**	**Fast Response Sensors**	**Air, Argon, Carbon Monoxide, Deuterium, Helium[2], Hydrogen[2], Hydrogen Chloride, Krypton, Neon, Nitrogen, Oxygen, Xenon**	**Ammonia, Carbon Dioxide, Chlorine, Hydrogen Sulfide, Methane, Nitrous Oxide, Phosphine**	**Acetylene, Arsine, Ethane, Ethylene, Silane, Sulfur Dioxide**	**Dichlorosilane, Halocarbon 12, Halocarbon 13, Halocarbon 13B1, Halocarbon 14, Isobutane, Propane, Propylene, Sulfur Hexafluoride**
PRS1FRC	–	PRS1FRM	5 sccm[1]	–	–	–
PRS2FRC	–	PRS2FRM	10 sccm[1]	5 sccm[1][3]	–	–
PRS3FRC	–	PRS3FRM	20 sccm	10 sccm[1][3]	5 sccm[1][3]	–
PRS4FRC	–	PRS4FRM	30 sccm	20 sccm[3]	10 sccm[1][3]	5 sccm[1][3]
PRS5FRC	–	PRS5FRM	50 sccm	30 sccm[3]	20 sccm[3]	10 sccm[1][3]
PRS6FRC	PRS6HPC	PRS6FRM	100 sccm	50 sccm[3]	30 sccm[3]	20 sccm[3]
PRS7FRC	PRS7HPC	PRS7FRM	200 sccm	100 sccm[3]	50 sccm[3]	30 sccm[3]
PRS8FRC	PRS8HPC	PRS8FRM	300 sccm	200 sccm[3]	100 sccm[3]	50 sccm[3]
PRS9FRC	PRS9HPC	PRS9FRM	500 sccm	300 sccm[3]	200 sccm[3]	100 sccm[3]
PRS10FRC	PRS10HPC	PRS10FRM	1000 sccm	500 sccm[3]	300 sccm[3]	200 sccm[3]
PRS11FRC	PRS11HPC	PRS11FRM	2000 sccm	1000 sccm[3]	500 sccm[3]	300 sccm[3]
PRS12FRC	PRS12HPC	PRS12FRM	3000 sccm	2000 sccm[3]	1000 sccm[3]	500 sccm[3]
PRS13FRC	PRS13HPC	PRS13FRM	5000 sccm	3000 sccm[3]	2000 sccm[3]	1000 sccm[3]
PRS14FRC	PRS14HPC	PRS14FRM	10 slpm	5000 sccm[3]	3000 sccm[3]	2000 sccm[3]
PRS15FRC	PRS15HPC	PRS15FRM	15 slpm	10 slpm[3]	5000 sccm[3]	3000 sccm[3]
PRS16FRC	PRS16HPC	PRS16FRM	20 slpm	15 slpm[3][4]	10 slpm[3]	5000 sccm[3]
PRS17FRC	–	PRS17FRM	30 slpm	20 slpm[3]	15 slpm[3]	10 slpm[3][4]
PRS18FRC	–	PRS18FRM	50 slpm	30 slpm[3]	20 slpm[3]	15 slpm[3][4]
PRS19FRC	–	PRS19FRM	100 slpm	50 slpm[3]	30 slpm[3]	20 slpm[3]
PRS20FRC	–	PRS20FRM	150 slpm	100 slpm[3]	50 slpm[3]	30 slpm[3]
PRS21FRC	–	PRS21FRM	200 slpm	150 slpm[3][4]	100 slpm[3]	50 slpm[3]
PRS22FRC	–	PRS22FRM	300 slpm	200 slpm[3]	150 slpm[3]	100 slpm[3][4]
PRS23FRC	–	PRS23FRM	500 slpm	300 slpm[3]	200 slpm[3]	150 slpm[3][4]
PRS24FRC	–	PRS24FRM	1000 slpm	500 slpm[3]	300 slpm[3]	200 slpm[3]

[1] Mass Flow Control Modules ordered for capacities of 10 sccm or less have been specially calibrated.
[2] Minimum flow range of 20 sccm available for hydrogen and helium.
[3] Contact your local Praxair representative to confirm compatibility of process gas with materials of construction.
[4] Contact your local Praxair representative to confirm maximum flow of selected process gas.

When ordering, specify gas type, operating temperature, inlet pressure, outlet pressure (not required for Mass Flow Sensors) and flow range for each module and sensor.
Calibration for one gas is included.

Gas Generators

High Purity Hydrogen Generators

PRAXAIR
Making our planet more productive

Hydrogen generators are an excellent source of ultra pure, dry hydrogen for a wide range of laboratory uses. The generators are used extensively with gas chromatographs, as a feed gas for flame ionization detectors (FID), as a reaction gas for hall detectors, and as a carrier gas to ensure absolute repeatability of retention times. In high sensitivity trace hydrocarbon analyzers and air pollution monitors, the hydrogen produced ensures the lowest possible background noise. Other applications include using hydrogen for hy-drogenation reactions and for FIDs used in the analysis of engine gas emissions in the automobile industry.

In all applications high purity hydrogen generators set the standard for safety, operational performance, and dependability while eliminating the need for high pressure cylinders of hydrogen in the laboratory. They are compact bench top units designed for use in the laboratory or in the field.

Hydrogen is generated on demand from no more than de-ionized water and electricity. The gas is stored only at low pressure, and the volume of stored gas is minimal. These features combined with a unique generator monitoring and alarm system provide unrivalled levels of end user safety, reliability, performance and cost of ownership.

Using hydrogen as a GC carrier gas significantly increases analysis speed and separation efficiency compared to helium. Gas costs and downtime are also significantly reduced due to the change from a cylinder-based supply.

Fully integrated, fully regenerative micro dryer technology provides the optimum combination of reliability, performance and cost of ownership for high purity applications.

Features and Benefits

- 99.9999% purity hydrogen on demand. Produces a continuous supply of pure hydrogen gas, ideal for carrier and fuel gas applications
- Fast time to gas
- Simple installation and operation
- Compact and reliable – only one square foot of bench space required
- Designed to run continuously 24 hours/day
- Easy to use digital controller with high visibility alarms. LED displays and gages indicate system status at a glance
- Safe – produces only as much gas as you need
- Easy annual maintenance
- Certified for laboratory use by CSA, UL, IEC 1010, and CE
- Only deionized water and standard electrical service are required for continuous operation
- Regulated pressure: 0 to 100 psig
- Complies with OSHA regulations 1910.103 by eliminating hydrogen cylinder storage
- Automatic over-pressure shutdown
- Minimal volume of stored hydrogen under pressure at any time (eliminates explosion hazard)
- Status indicators with alarms and automatic shutdown for safe, continuous operation
- Optional remote PC monitoring and control

Specifications

- **Hydrogen Purity**
  99.9999%
- **Hydrogen Outlet Pressure**
  Adjustable 0-100 psig
- **Maximum Hydrogen Flow Rate**
  PRS20H-MD: 160 ml/min
  PRS40H-MD: 250 ml/min
  PRS60H-MD: 500 ml/min
  PRS110H-MD: 1100 ml/min

Ordering Information

Part Number	Flowrate ml/min	Purity%	Pressure	Connections BSP H_2 Outlet	Voltage Vac
PRS20H-MD	160	99.9999	0-100 psi (0-7 bar)	1/8" Swagelok	110-230
PRS40H-MD	250	99.9999	0-100 psi (0-7 bar)	1/8" Swagelok	110-230
PRS60H-MD	500	99.9999	0-100 psi (0-7 bar)	1/8" Swagelok	110-230
PRS110H-MD	1100	99.9999	0-100 psi (0-7 bar)	1/4" Swagelok	110-230

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Gas Generators

Zero Air Generators

Zero air generators produce a continuous flow of clean, dry air with an ultra low residual methane content of less than 0.05 ppm from an existing compressed air supply.

An interchangeable top panel allows for direct mounting of a UHP hydrogen generator.

The generators can be used to supply zero air to GC-FID, FPD, NPD, LC/MS, THA and gas sensing applications.

Zero air generators are easy to install. All that is required is a standard compressed air line and an electrical outlet. There are no complicated operating procedures to learn or any labor intensive monitoring required.

Features and Benefits

- Gas quality assured – Catalyst air temperature monitoring and display gives reliable indication of gas purity. High performance filtration effectively removes contamination.
- Improved instrument performance – Guaranteed consistent purity reduces baseline noise and improves stability
- Maximized uptime, maximized productivity – No cylinder changes mean no interruptions to analyses and no instrument re-calibration. Cleaner air reduces frequency of instrument cleaning
- Economy – Quick return on investment, typically 12 months
- Operates at low pressures, from 5 to 125 psig
- Simple operation, minimal maintenance
- Digital temperature display
- CE, UL and CRN approved

Specifications

- **Outlet Hydrocarbon Concentration (as methane)**
  <0.05 ppm
- **Minimum/Maximum Inlet Air Pressure**
  40 psig/125 psig
- **Maximum Inlet Hydrocarbon Concentration (as methane)**
  100 ppm
- **Pressure Drop at Max Flow Rate**
  1.0 psig
- **Maximum Inlet Air Temperature**
  78 °F (25 °C)
- **Inlet/Outlet Ports**
  1/4" FPT
- **Start-Up Time for Specified Hydrocarbon Concentration (as methane)**
  45 minutes
- **Electrical Requirements**
  120 vac/60Hz

Ordering Information

Part Number	Flowrate L/min	Purity/Total Hydrocarbon Content	Connections		Voltage Vac
			Air Inlet	Air Outlet	
PRSUHP-10ZA	1.0	< 0.05 ppm	1/8" Swagelok	1/8" Swagelok	115/230
PRSUHP-35ZA	3.5	< 0.05 ppm	1/8" Swagelok	1/8" Swagelok	115/230
PRSUHP-50ZA	5.0	< 0.05 ppm	1/4" Swagelok	1/4" Swagelok	115/230
PRSUHP-75ZA	7.5	< 0.05 ppm	1/4" Swagelok	1/4" Swagelok	115/230
PRSUHP-150ZA	15.0	< 0.05 ppm	1/4" Swagelok	1/4" Swagelok	115/230
PRSUHP-300ZA	30.0	< 0.05 ppm	1/4" Swagelok	1/4" Swagelok	115/230

Gas Generators

Nitrogen Generators

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MidiGas and *MaxiGas* nitrogen generators provide flowrates typically ranging from 10 l/min to 882 l/min at purities from 10 ppm to 3% oxygen content. Even higher flowrate generators can be provided if required.

The larger flowrates achieved by the *MaxiGas* generator are ideally suited for use as the basis of centralized laboratory nitrogen supply systems capable of servicing multiple instruments and applications. System modularity allows the capacity of the system to be easily increased as laboratory operations expand.

Features and Benefits

- Produces a continuous supply of high purity nitrogen gas from existing compressed air
- Compact design frees up floor space
- Offers long term cost stability Ideal for carrier gas or solvent evaporation applications
- Safe, reliable, low maintenance
- Cost effective for applications demanding high purity nitrogen

Ordering Information

	Part Number	Flowrate L/min	Purity % O_2	Connections BSP		Voltage Vac
				Air Inlet	Air/Gas Outlet	
Zero Nitrogen	PRSG5	1.0	10 ppm	1/8"	1/8"	110/230
N_2 and Dry Air	PRSG6	N_2: 0.6	10 ppm	1/8"	1/8"	110/230
		Air: 1.5	-55 °C adp	1/8"	1/8"	110/230
	PRSG7	N_2: 3.0	10 ppm	1/8"	1/8"	110/230
		Air: 3.0	-55 °C adp	1/8"	1/8"	110/230
Dry Air	PRSG8	3.0	-55 °C adp	1/8"	1/8"	110/230
	PRSG9	6.0	-55 °C adp	1/8"	1/8"	110/230

PRAXAIR
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Gas Generators

Generator Back-up Systems

Praxair's generator back-up system is now available in a complete package, ready for installation. Back-Up systems are available for air, hydrogen and nitrogen analytical gas generators. These systems are designed to meet the highest safety and quality standards necessary to safeguard instruments against unexpected supply interruption.

These systems control pressure, prevent back flow, and maintain high purity gas standards so critical in today's laboratory environment. All components including regulators, flex hoses, valves and fittings meet instrumentation gas specifications.

Features and Benefits

- Eliminates unscheduled down time, high purity gas is continuously supplied to the laboratory
- Praxair generators may be serviced or cylinders changed out without interrupting gas supply
- The system is designed and the components selected for high purity laboratory applications
- Back-up cylinder pressure control is achieved through differential pressure principle

Specifications

- **Maximum Inlet Pressure**
  3000 psig
- **Operating Temperature**
  -20 °F to +160 °F
  (-29 °C to +71 °C)
- **Inlet/Outlet Connections**
  CGA connection and 1/4" compression fitting. Optional 1/8" compression fittings are available
- **Outlet Delivery Pressure Range**
  Pressure regulator: 0-100 psig
- **Pigtail Length**
  3 Feet
- **Panel Size**
  10" W x 11" H
  (25.4 cm x 28 cm)

Materials

- **Regulator**
  Body: Brass/316L SS
  Diaphragm: 316L
  Internal seals: PTFE Teflon®
  Seat: PTFE Teflon®
  Filter: 10 micron multilayer, sintered 316L stainless steel wire mesh (patented)
- **Check Valves**
  Body: Brass/316L SS
  Seal: Viton®
- **Diaphragm Valves**
  Body: Brass/316L SS
  Diaphragm: 316L SS
  Seat: Metal to metal
- **Mounting Panel**
  Stainless steel
- **Weight**
  8 lb (3.6 kg)

Ordering Information – Series PRS5GBABCDEF

A	B	C	D	E	F
Material	**Inlet Gauge**	**No. of Regulators**	**Pigtail Type**	**Reserve/Remote Inlet**	**Outlet**
B: Brass S: Stainless Steel	3: 4000 psi 5: 1000 psi 6: 300 psi 7: 700 psi	0: (200 psi outlet gauge only) 1: (150 psi reg with 200 psi gauge)	1: 36" 2: 72"	0: none (for reg qty 1) A: Air CGA 590 H: Hydrogen CGA 350 N: Nitrogen CGA 580	0: 1/4" tube 1: 1/8" tube 2: 1/4" FPT 3: 1/4" MPT

PRAXAIR
Making our planet more productive

Series M3 125 psig
Series M5 205 psig

Free standing including rotary screw air compressor.

PRX M3 or PRX M5 N_2 Generator with Air Compressor and air tank

Series M3 125 psig

Model	CFH @ 99.9% N_2 or 1000 ppm O_2	CFH @ 99.5% N_2 or 5000 ppm O_2	CFH @ 99% N_2 or 10,000 ppm O_2	CFH @ 98% N_2 or 1000 ppm O_2	CFH @ 97% N_2 or 1000 ppm O_2	CFH @ 96% N_2 or 1000 ppm O_2	CFH @ 95% N_2 or 1000 ppm O_2	Power
PRX M3-F100	50	101	134	197	257	314	388	
PRX M3-F200	101	201	268	394	514	628	776	
PRX M3-F300	151	300	402	591	771	942	1164	
PRX M3-F400	201	400	536	788	1028	1256	1552	
PRX M3-F500	238	476	635	918	1200	1447	1730	
PRX M3-F1000	476	952	1270	1836	2400	2894	3460	

Includes 145 psig low oil output rotary screw air compressor providing 120 psig working pressure.

Meets Air Separation Membrane Specification ISO 8573.1:2001 Class 4.4.4

Maintenance – Once every six months per owner's manual.

Options:

Food Grade Oil. Two Stage Sterile Air Filtration.

- Virus and Bacteria removal to 0.01 micron
- Meets Compressed Air and Gas Requirements for Dairy, Brewery and Food Processing Industries

Series M5 205 psig

Model	Output flow @ 99.9% in CFH	Output flow @ 99.5% in CFH	Output flow @ 99.0% in CFH	Output flow @ 98.0% in CFH	Output flow @ 97.0% in CFH	Output flow @ 96.0% in CFH	Output flow @ 95.0% in CFH	Filter Kit for N_2 Generator for only
PRX M5-F750	375	750	1048	1200	1554	2369	2500	FMKN175
PRX M5-F1500	750	1500	2096	2400	3108	4738	5000	FMKN280
PRX M5-F2250	1125	2250	3144	3600	4662	7107	7500	FMKN325
PRX M5-F3000	1500	3000	4192	4800	6216	9476	10000	FMKN450

Includes 217 psig low oil output rotary screw air compressor providing 204 psig working pressure.

Meets Air Separation Membrane Specification ISO 8573.1:2001 Class 4.4.4

Maintenance – Once every six months per owner's manual.

Options:

Food Grade Oil. Two Stage Sterile Air Filtration.

- Virus and Bacteria removal to 0.01 micron
- Meets Compressed Air and Gas Requirements for Dairy, Brewery and Food Processing Industries

Gas Generators

Nitrogen Supply System

Series M1

Wall and Cabinet Systems – Compressor not included.

PRX M1-126

Series M1

Model	Output flow @ 99.9% in CFH	Output flow @ 99.5% in CFH	Output flow @ 99.0% in CFH	Output flow @ 98.0% in CFH	Output flow @ 97.0% in CFH	Output flow @ 96.0% in CFH	Output flow @ 95.0% in CFH	Annual Filter Kit
PRX M1-2	1	2	5	7	10	12	14	–
PRX M1-18	8	18	23	34	42	53	64	–
PRX M1-63	32	63	84	130	165	204	243	–
PRX M1-126	63	126	168	260	330	408	486	–
PRX M1-189	95	189	252	390	495	612	729	–
PRX M1-317	159	317	423	600	776	953	1130	–
PRX M1-634	318	634	846	1200	1554	1906	2260	–
PRX M1-951	476	951	1269	1800	2331	2859	3390	–
PRX M1-1268	634	1268	1692	2400	3108	3812	4520	–

Options:

Oxygen analyzer – oxygen percentage read out only.

Oxygen manager – oxygen percentage set and maintained with a read out display.

Two Stage Sterile Air Filtration.

- Virus and Bacteria removal to 0.01 micron
- Meets Compressed Air and Gas Requirements for Dairy, Brewery and Food Processing Industries

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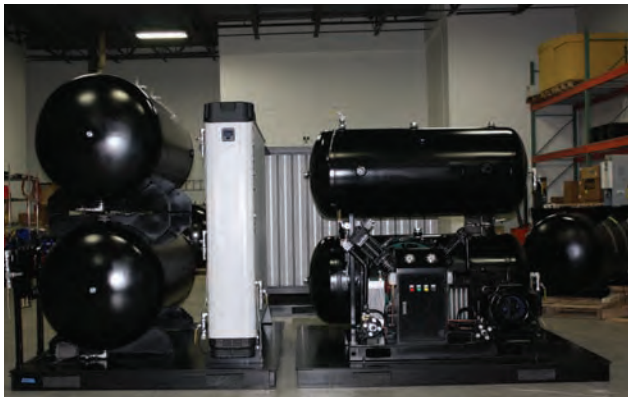
Making our planet more productive

Series P1

Pressure Swing Adsorption (PSA) systems may have a larger foot print than the Series M, membrane N_2 generators, but the Series P has the ability to produce a higher purity with the same or less horsepower.

P1 – 500 without an air compressor

- Series P1 consists of a PSA for use with a customer's air compressor system.
- Series P3 includes PSA with an air compressor design for the application with a delivery pressure of 125psig or less.
- Series P7 includes PSA, air compressor and booster to deliver nitrogen to the application at 325 psig or less.



P7 – 500 includes an air compressor

Series P

	Output flow @ 99.999% in CFH	Output flow @ 99.99% in CFH	Output flow @ 99.95% in CFH	Output flow @ 99.90% in CFH	Output flow @ 99.5% in CFH	Output flow @ 98.0% in CFH	Output flow @ 95.0% in CFH
P1-125	19	56	74	88	132	194	291
P1-300	39	120	162	180	288	420	600
P1-400	58	169	222	265	396	583	874
P1-500	78	26	297	353	530	777	1165
P1-1000	155	452	593	706	1059	1554	2330
P1-2100	311	904	1186	1412	2119	3107	4661
P1-3200	466	1356	1780	2119	3178	4661	6991
P1-4200	622	1808	2372	2824	4238	6214	9322
P1-5200	776	2260	2966	3532	5296	7766	11652
P1-6200	932	2712	3560	4230	6356	9322	13982

PSA beds are 71" tall by 16" wide and vary from 32" - 92" deep, making it easy to bring this equipment in through 32" x 6' 8" man or service door.

Oxygen content or Nitrogen purity is controlled through the PLC controller.

PSA modules have a IP address for remote monitoring for data acquisition.

Gas Generators

Nitrogen Supply System

Series D

Compressed Air commonly contains 2,000 ppm water and more than 5 ppm of THC and particulate from old pipes. The Series D removes water to a low vapor dew point pressure of -100 ^{O}F or 1.5 ppm and THC to less than 1 ppm, without particulate larger than 0.01 microns. Series D eliminates particulate larger than 0.01 microns.

D series conditions your instrument air to an ideal state while reducing instrument maintenance and reducing retesting due to erroneous results.

This simple wall mount system remove more than 99.9% of the water and THC from your compressed air supply. No moving parts and no tools required for service provides a compact source for an instrument quality air supply.

PRX D-13N

Series D

Model	Inlet Air @ 100 psig @ +38 ^{0}F VPDP[1]	Outlet Air @ 100 psig @ -45 ^{0}F VPDP[1]	Outlet Air @ 100 psig @ -70 ^{0}F VPDP[1]	Outlet Air @ 100 psig @ -100 ^{0}F VPDP[1]
PRX D6N	10	6	3	1.5
PRX D13N	20	13	6.5	3.2
PRX D18N	27	18	9	4.5
PRX D22N	33	22	11	6.5
PRX D29N	42	29	14.5	7.2
PRX D38N	50	38	19	9.5

[1] Vapor Pressure Dew Point (PDP)

Maximum inlet pressure is 145 psig.

D Series output increases proportionally to the input pressure.

Example – PRX D18N input pressure 100 psig produces 18 cfm at -45 °F vpdp, if input pressure were 125 psig then output would be:

18 cfm x 1.25 = 22.50 cfm at -45 °F vpdp

Praxair's Series 11 Nitrogen Generators

Point-of-Use Nitrogen Supply

Unique PRAXAIR® Nitrogen Generators provide a durable method to consistently produce high-purity nitrogen from your compressed air system.

The 11-126 produces 90,000 cubic feet per month of 99.5% pure nitrogen with no moving parts and minimal maintenance. The 11-126 and larger model 11-317 are the most commonly used models in North America .

Cost of nitrogen from these devices is 85% less than liquid nitrogen.

Applications for Point-of-Use Nitrogen

- Laser Beam Purge
- Cabinet inerting or purging
- Vessel inerting or purging
- Laboratory nitrogen supply
- Oxidation prevention
- Increase shelf life of perishables
- Inert atmospheres
- Electronics storage
- Optic glove-box

Easy Installation

Installation is quick and easy. The Praxair Nitrogen Generator and coalescing prefilters are pre-assembled in-line so wall or frame mounted takes only minutes.

Inlet connection is ½" FNPT with a ¼" FNPT outlet. Incoming air needs to be 100 – 200 psig, 6 cfm without solvents and Freon® with less than 5 ppm of THC as vapor and water content should be less than 40 °F pressure dew point.

Maintenance

Praxair's automatic maintenance notification program makes managing semi-annual maintenance easy. This keeps your nitrogen gas generation system operating at peak performance for years.

Simply fill out the warranty card in the shipping box for email notification of semi-annual maintenance. If you loose your registration card simply call (262) 513-2928 to register. This reminder from Praxair validates the nitrogen generator warranty, makes maintenance scheduling easier and helps extend the life of your equipment.

Praxair Series 11-126 Nitrogen Generator

Series 11

Model	100 psig inlet - 99.5% Purity Flow/cfh	150 psig inlet - 99.5% Purity Flow/cfh
11-2	2	3
11-18	18	27
11-63	63	94
11-126	126	189
11-317	317	475
11-634	634	951

Higher purity is available at reduced flow or inlet pressure

Series 5000 – Teflon® Membrane Gas Line Filter, 0.01 Microns

The medium in this filter efficiently traps particles down to 0.01 microns. These units may be installed in gas lines supplied by cylinder or bulk sources. Both the materials and manner of construction render the 5000 Series units compatible with a wide variety of gases. Any combination of fittings are available. Some typical configurations are shown in the table below.

Series 5000
Gas Line Filter

Features

- 100% efficient at 0.01 micron level
- Filter medium – porous PTFE Teflon membrane
- All welded 316L stainless steel construction
- High capacity for particle retention due to Teflon medium and physical size
- Seal: Teflon encapsulated, silicon O-Ring
- Excellent compatibility with a wide variety of gases
- Filter area: 0.5 sq. ft.
- Maximum operating pressure:
  - 1000 psi @ 70 °F
  - 250 psi @ 100 °F
- Temperature rating: 100 °F

Specifications and Ordering Information

Type of Connection	Model Number	Connection Size (Inches)	Dimensions			
			Length		Diameter	
			Inch	MM	Inch	MM
Standard Pipe	PRS5001	1/4" NPT F X F	4.75	120.6	2.20	55.9
Compression	PRS5101	1/4" F X F	5.56	141.1	2.20	55.9
	PRS5102	3/8" F X F	5.81	147.6	2.20	55.9
	PRS5103	1/2" F X F	5.81	147.6	2.20	55.9
Face Seal	PRS5201	1/4" M X M	5.56	142.7	2.20	55.9
	PRS5202	1/4" M X M	5.00	127.0	2.20	55.9
	PRS5203	1/4" F X M	5.56	141.2	2.20	55.9
	PRS5204	3/8" M X M	5.81	147.6	2.20	55.9

Depth Type Gas Filters - 0.2 Microns Series 7100

The 7100 Series depth filters are the work-horses of laboratories and many critical industrial processes. They are routinely used in critical gas line applications and as pre-filters to extend the lifetime of more expensive filtration units. They are designed to provide high filtration efficiency at an economical cost.

The 7100 Series filters employ a microporous fiberglass media held in a 316 stainless steel all welded housing. Any combination of fittings is available. Some typical configurations are show in the table below.

Series 7100
Depth Gas Filter

Features

- 100% filtration efficiency at 0.2 micron level
- Filter media compatible with a wide range of gases
- Long service life
- Particles are collected in the filter matrix throughout the depth of the filter
- All welded 316 stainless steel construction
- Operating Pressure: 250 psig
- Operating Temperature: 0° F to 165° F

Series 7200
Depth Gas Filter

Ordering Information

Model	Connections Inlet and Outlet	Dimension (inches)		Max Flow @ 15 psig Inlet slpm
		Length	Diameter	
PRS7110-P4FF	1/4" NPT Female	3.31	2.20	100
PRS7110-V4MM	1/4" Face Seal Male	4.42	2.20	100
PRS7110-T2FF	1/8" Tubing Compression	4.16	2.20	30
PRS7110-T4FF	1/4" Tubing Compression	4.38	2.20	100
PRS7110-V6MM	3/8" Face Seal Male	4.68	2.20	150
PRS7120-P4FF	1/4" NPT Female	5.84	2.20	150
PRS7120-T4FF	1/4" Tubing Compression	6.91	2.20	100
PRS7120-T6FF	3/8" Tubing Compression	7.11	2.20	400
PRS7120-T8FF	1/2" Tubing Compression	7.37	2.20	400
PRS7120-V4MM	1/4" Face Seal Male	6.95	2.20	100
PRS7120-V6MM	3/8" Face Seal Male	7.21	2.20	150

High Pressure, High Purity, Stainless Steel In-Line Filters Models SG6112, SG6113, SG6114

These in-line filters have a pleated wire mesh element which is easily cleaned by flushing the filter in the opposite direction to normal flow. Flow may be in either direction. All metal welded construction makes these filters ideal for use in high purity and ultra high purity gas systems.

SG6112/13 Filter

SG6114 Filter

Specifications

- **Maximum Operating Pressure:** 6000 psig
- **Operating Temperature Range:** -320 °F to +900 °F
- **Maximum Differential Pressure:** 100 psi
- **Pressure Drop (to atmosphere) SG6112:**
  10 psi at 156 slpm Air
  50 psi at 433 slpm Air
  100 psi at 768 slpm Air
- **Pressure Drop (to atmosphere) SG6113 and SG6114:**
  10 psi at 140 slpm Air
  50 psi at 389 slpm Air
  100 psi at 691 slpm Air
- **Dimensions**
  SG6112 and SG6113: 1-3⁄4" x 1" hex
  SG6114: 2-1⁄32" x 1" hex
- **Approximate Weight**
  4 oz

Materials

- **Body**
  Type 316 Stainless Steel
- **Retainer Screens**
  Type 316 Stainless Steel
- **Pleated Mesh Element**
  SG6112: Type 316 Stainless Steel
  SG6113 and SG6114: Type 304 Stainless Steel

Ordering Information

Part Number	Inlet and Outlet Connections*	Nominal Filtration Rating
PRXSG6112	1⁄4" MPT by 1⁄4" FPT	15 micron
PRXSG6113	1⁄4" MPT by 1⁄4" FPT	2 micron
PRXSG6114	1⁄4" male VCR® (both ends)	2 micron

High Pressure, Brass In-Line Filters (Models SG6120, SG6121, SG6122)

These in-line filters feature a sintered 316 stainless steel element which is easily removed for cleaning or replacement making these filters convenient for use upstream of pressure regulators. These filters will protect a regulator from particulate contamination which can build up and eventually cause seat leakage and regulator failure.

SG6120 Filter

Specifications

- **Maximum Operating Pressure:** 3000 psig
- **Operating Temperature Range**
  -15 °F to + 400 °F
- **Dimensions**
  2-1/4" x 3⁄4" hex
- **Approximate Weight:** 3 oz
- **Connections**
  1/4" FPT (in) x 1/4" FPT (out)

Materials

- **Body**
  Brass
- **Spring, Element and Gasket**
  Type 316 Stainless Steel
- **Seal**
  Viton®

Ordering Information

Part Number	Nominal Filtration Rating
PRSSG6120	10 micron
PRSSG6121	5 micron
PRSSG6122	1 micron

Optional Equipment – Replacement Element (Includes Seal and Spring)

Part Number	Description
PRSSG6120R	10 micron
PRSSG6121R	5 micron
PRSSG6122R	1 micron

Low flow, 2-Micron, In-Line Filters (Models FM4741, FM4746)

Models FM4741 and FM4746 in-line filters feature a sintered stainless steel element with a 2 micron filtration rating. The element is easily removed for cleaning. Model FM4741, with an aluminum housing, is designed for non-corrosive gas service. The FM4746, with a Type 316 stainless steel housing, is suitable for corrosive service. The 1⁄8" NPT inlet and outlet connections make these filters convenient for use in conjunction with many of Praxair's variable area flowmeters.

FM4741 Filter

Specifications

- **Filtration Rating**
  2 micron
- **Dimensions**
  2-13/32" x 1/2" hex
- **Approximate Weight**
  1.5 oz

Materials

- **Filter Element**
  Type 316 Stainless Steel
- **Spring**
  Type 302 Stainless Steel
- **Seals**
  Viton®

Ordering Information

Part Number	Body	Maximum Operating Pressure at 70 °F	Temperature
PRSFM4741	Aluminum	3500 psig	180 °F
PRSFM4746	Type 316 Stainless Steel	5000 psig	350 °F

Purifiers/Filters

Filters for Specialty Gases and Liquids

Gas and liquid sample analyzer filters help protect analyzers from sample impurities by removing solids and liquids from gases with 99.99% efficiency at 0.01 micron. Sample filters offer liquid filtration efficiency to 2 micron or lower.

Typical Applications

- Gas and liquid sample analyzers
- Cylinder gas filtration

Features and Benefits

- Remove liquids and solids from gas samples
- Remove solids and gas bubbles from liquid samples
- Coalesce and separate two liquid phases
- Filter solids and liquids from gases with 99.99% efficiency at 0.01 micron
- Inert to most gases and liquids
- Temperature resistance to 300 °F (150 °C)
- Low pressure drop
- Long life between filter element changes
- All filters are CRN registered across Canada

Filter Cartridge Description

- **Q-Type Cartridges**
  Used for solids and trace amounts of liquids in gases. Provides excellent chemical resistance, temperature resistance to 300 °F (150 °C), and good mechanical handling properties.
- **Gas Filtration at 0.01µm**
  99.99%
- **Liquid Filtration at 2µm**
  98%

Specifications and Ordering Information

Model	BLS95S6	BLS37/12	BLS37/25	BLS27/35-3000	BLS27/80-3000
Flow Rate (100/3000 psig)	10/260 scfm	22/579 scfm	55/1447 scfm	129/3380 scfm	195/5000 scfm
Inlet and Outlet Ports	1/8" NPT	1/2" NPT	1/2" NPT	1" NPT	1" NPT
Drain Port	1/8" NPT	1/8" NPT	1/8" NPT	1/4" NPT	1/4" NPT
Maximum Temperature	400 °F (204 °C)	400 °F (204 °C)	400 °F (204 °C)	400 °F (204 °C)	400 °F (204 °C)
Maximum Pressure[1]	5000 psig	4000 psig	4000 psig	3000 psig	3000 psig
Shipping Weight	1 lb (0.4 kg)	6 lb (3 kg)	10 lb (5 kg)	25 lb (11 kg)	25 lb (11 kg)
Dimensions	1.8" D x 4" L (4.6 cm x 10.1 cm)	2.8" D x 5.8" L (7.1 cm x 14.7 cm)	2.8" D x 10" L (7.1 cm x 25.4 cm)	4.0" D x 16" L (10.1 cm x 40.6 cm)	4.0" D x 27" L (10.1 cm x 68.6 cm

[1] Maximum pressure ratings are for temperatures to 200 °F (93 °C). Please consult Praxair for maximum pressure ratings at elevated temperatures.

Materials

Model	BLS95S6	BLS37/12	BLS37/25	BLS27/35-3000	BLS27/80-3000
Head, Bowl, Internals[2]	316SS	316SS	316SS	316SS	316SS
Seals	Viton®	Viton®	Viton®	Viton®	Viton®

[2] Constructed of materials which comply with NACE specification MR-01-75. Request certificate of compliance.

Option

Filter Model	BLS95S6	BLS37/12	BLS37/25	BLS27/35-3000	BLS27/80-3000
Support core, required for liquid filtration	Included	BLSSS-100-12	BLSSS-100-25	BLSSS-200-35	BLSSS-200-80
Filter cartridges (box of 10)	BLS050-11-BQ	BLS100-12-BQ	BLS100-25-BQ	BLS200-35-BQ	BLS200-80-BQ

Purifiers/Filters

Gas Specific Purifier and Containment Trap Purifiers

PRAXAIR
Making our planet more productive

Gas specific purifier modules are designed to be placed in-line with the Gas Chromatograph (GC) carrier gas supply or the GC detector gas supply. There are three groups of contaminants that impact gas chromatography: moisture, hydrocarbons and oxygen. The Gas Specific Purifiers remove the three contaminant groups from analytical gases prior to entering the GC. Proprietary absorptive materials capture and retain contaminants for the operating life of the purifier.

The new gas specific purifier modules offer dramatic reductions in most contaminant levels (from many parts per million to levels that are below the lower limit of analytical detection) and absorb a larger number and variety of contaminants than other competitive products. The performance is optimized by incorporating a multiple bed form so that each successive bed functions at a lower contaminant concentration. The result is a series of contaminant concentration gradients across the length of the purifier module. When these advanced materials and design features are combined with a known gas contaminant concentration, the following performance should be achieved.

Gas purifiers are designed to help insure the purity of your analytical gases at the point of use. Even though you may be purchasing ultra-high purity gases, your delivery system may be compromising the level of gas purity you require. The best way to make sure your instruments are receiving the highest level of gas purity is to utilize point of use purification.

Inlet gas containing oxygen, moisture and hydrocarbons

High purity outlet gas

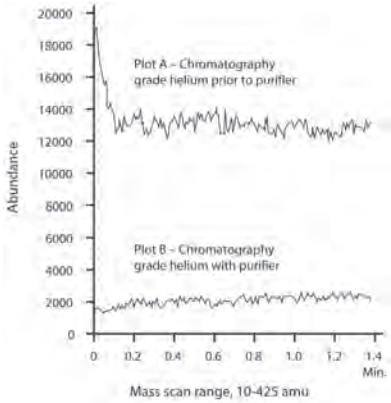
By combining several beds of specialized sorbent materials, a contaminant gradient is formed across the entire length of the purifier. This successive bed format achieves the highest purity gas commercially available.

Features and Benefits

- Decrease baseline noise and increase GC/MS sensitivity
- Reduce gas impurities from high ppm to low ppb levels
- The ultimate purification technology

Specifications

- **Length**
  21" (52.3 cm)
- **Diameter**
  1.5" (3.8 cm)
- **Maximum Inlet Pressure**
  300 psig (2070 kPa)
- **Maximum Recommended Flow**
  500 ml/min
- **Pressure Drop, 827 kPa (120 psig) inlet, at a flow of 0 to 500 ml/min**
  < 2.1 kPa (0.30 psig)
- **Compression End Connections**
  1/8" or 1/4"
- **Shipping Weight**
  1.76 lb (800 g)



Designed to deliver gases at the point of use that are at least as pure as what was purchased in the cylinder. Point of use purification is the best way to help insure that your application is receiving the highest level of gas purity possible.

Ordering Information

Product Description	Part Number	Fitting	CO	CO_2	O_2	H_2O	Sulfur Compounds	NMHC*
Helium Purifier	PRS-100-1 PRS-100-2	1/8" 1/4"	< 1	< 1	< 1	< 1	< 1	< 3
Hydrogen Purifier	PRS-200-1 PRS-200-2	1/8" 1/4"	< 1	< 1	< 1	< 1	< 1	< 3
Nitrogen Purifier	PRS-300-1 PRS-300-2	1/8" 1/4"	< 1	< 1	< 1	< 1	< 1	< 3
Air Purifier	PRS-400-1 PRS-400-2	1/8" 1/4"				< 1		< 3
Moisture Trap	PRST-100-1 PRST-100-2	1/8" 1/4"				< 1		
Hydrocarbon Trap	PRST-200-1 PRST-200-2	1/8" 1/4"						< 3
Oxygen Trap	PRST-300-1 PRST-300-2	1/8" 1/4"			< 1	< 1		
Sulfur Trap	PRST-400-1	1/8"				< 1	< 1	
Methane Purifier	PRST-500-1	1/8"	< 1	< 1	< 1	< 1	< 1	< 3

Note: Above values are expressed as ppb levels.
Guide assumes inlet gas supply less than 50 ppm (contaminents).

* NMHC stands for non-methane hydrocarbons.

Purifiers/Filters

High and Low Pressure Purifiers

The SG6140 purifier is designed to remove water and/or oil from gas or liquid streams. It protects sensitive instruments, prolongs service life and provides more accurate, reproducible test results. This purifier may be used with non-corrosive gases compatible with brass and Viton® at pressures up to 3000 psig. Three different purifying elements are available (see Ordering Information and Optional Equipment). These elements can be replaced without removing the purifier from the process line.

SG6140 Purifier *Element*

Specifications

- **Maximum Operating Pressure**
  2000 psig 500 for O_2
- **Pressure Drop**
  1.0 psi at 56 slpm Air, 2.4 psi at 85 slpm Air
- **Dew Point Obtainable 4A/13X Molecular Sieve:**
  -100 °F (-75°C)
- **Inlet & Outlet Connections**
  1/4" FPT
- **Dimensions**
  5-11/16" H x 2" D
- **Mounting Holes (2)**
  1/4" 20UNC x 3/8" deep
- **Approximate Weight:** 2 lb

Materials

- **Purifier**
  Body and Cap: Aluminum/Brass
  O-Ring Seal: Bonan
- **Purifier Element**
  Housing: Electrolytic Tin-Plated Cold-Rolled Steel
- **Purifier Element**
  Retainer: Polyester Felt Backed Type 316 SS Screen
- **Purifier Element**
  Desiccant: 4A, 13X or Activated Charcoal as ordered

Ordering Information

Part Number	Element Type*	Used for Removing	Water Capacity at Flow Rate of 2 scfm at 80 °F
PRSSG6140	None	N/A	N/A
PRSSG6140-1	Type 13X Molecular Sieve	Oil and Water	6.5 grams
PRSSG6140-2	Type 4A Molecular Sieve	Water	7.2 grams
PRSSG6140-3	Activated Charcoal	Oil and Heavy Hydrocarbons**	N/A

* Elements are shipped in individually packed, hermetically sealed cans to prevent deterioration. They must be installed before using the purifier.

** Will remove trace amounts of Acetone in Acetylene.

Optional Equipment

Part Number	Replacement Elements and O-Ring
PRSSG6141	Type 13X Molecular Sieve
PRSSG6142	Type 4A Molecular Sieve
PRSSG6143	Activated Charcoal
PRS0202-3268	Replacement Viton® O-Ring

Low Pressure, High Flow Purifier (Model AG6170)

The AG6170 purifier protects sensitive instruments from water and/or oil contamination which ensures more accurate, reproducible test results and prolongs the instrument's service life. This purifier (capable of removing up to 20 times more water than our Model SG6140), may be used with non-corrosive gases compatible with aluminum and neoprene at inlet pressures up to 350 psig. Three different purifying elements are available (see Ordering Information and Optional Equipment). These elements can be replaced without removing the purifier from the process line.

AG6170 Purifier, Element and Gaskets

Specifications

- **Maximum Operating Pressure**
  350 psig
- **Operating Temperature Range**
  -40 °F to +200 °F
- **Maximum Flow Capacity**
  10 scfm for short periods
  1-3 scfm for extended use
- **Pressure Drop**
  0.12 psi at 3 scfm
  1 psi at 7.5 scfm
- **Inlet & Outlet Connections**
  1/4" MPT
- **Dew Point Obtainable (4A and 13X M.S.):**
  -100 °F (1.5 ppm)
- **Dimensions**
  15-5/8" H x 4-3/4" D
- **Approximate Weight**
  4 lb

Materials

- **Purifier**
  Shell and Flange Plate: Aluminum
  Seals: Neoprene
- **Purifier**
  Strainer Assembly:
  Monel and Brass
- **Purifier Element**
  Housing: Electrolytic Tin-Plated Cold-Rolled Steel
  Retainer: Polyester Felt Backed by Type 316 SS Screen
- **Purifier Element**
  Desiccant: 4A, 13X or Activated Charcoal as ordered

Ordering Information

Part Number	Element Type	Used for Removing	Water Capacity
PRSAG6170	None	N/A	N/A
PRSAG6170-1	Type 4A Molecular Sieve	Water	134 grams
PRSAG6170-2	Type 13A Molecular Sieve	Oil and Water	126 grams
PRSAG6170-3	Activated Charcoal	Oil and Heavy Hydrocarbons**	N/A

* Elements are shipped in individually packed, hermetically sealed cans to prevent deterioration. They must be installed before using the purifier.

** Not suitable for Acetylene service.

Optional Equipment

Part Number	Replacement Element (includes replacement gaskets)
PRSSG6171	Type 4A Molecular Sieve
PRSSG6172	Type 13X Molecular Sieve
PRSSG6173	Activated Charcoal

Glass Encased, Low Pressure, High Purity Moisture Trap

These traps (Models SG6190 and SG6191) consist of a silanized, borosilicate glass tube which is filled with Type 13X Molecular Sieve and Type 4A Indicating Molecular Sieve for removal of moisture from the gas stream. The Type 4A indicating sieve will undergo a color change (from blue to buff) to alert when the adsorbent requires replacement. The glass housing has been encapsulated in a secondary clear plastic outer tube to provide protection from potential glass breakage.

SG6191 Moisture Trap

Standard Features

- Borosilicate glass inner housing eliminates contamination from diffusion or out-gassing commonly associated with purifiers made of plastic.
- Transparent housing permits quick observation of the adsorbent's condition.
- Sintered type 316 stainless steel inlet and outlet filters retain the adsorbent within the column.
- Pre-purged and pressure tested with ultra-high purity helium to insure integrity.
- Available in two different sizes.

Specifications

- **Maximum Operating Pressure** 120 psig
- **Maximum Operating Temperature:** 100 °F
- **Maximum Flow Capacity** 5 slpm at 125 psi inlet
- **Water Capacity**
  Model SG6190: 200 cc
  Model SG6191: 400 cc
- **Inlet and Outlet Connections** 1/4" compression 1/8" compression
- **Approximate Weight:** 2 lb

Materials

- **Housing**
  Inner Tube: Silanized Borosilicate Glass
  Outer Tube: Polycarbonate Plastic
- **Seals** Zytel-A Nylon Resin
- **Fittings** Nickel-Plated Brass
- **Filters, 40 micron** Type 316 Stainless Steel
- **Adsorbent Material** Type 13X Molecular Sieve and 4A Indicating Molecular Sieve

Ordering Information

Part Number	Capacity	Size
PRSSG6190-1	200 cc 1/4"	2" diameter x 14" long
PRSSG6191-1	400 cc 1/4"	2" diameter x 14" long
PRSSG6190-2	200 cc 1/8"	2" diameter x 7-1/2" long
PRSSG6191-2	400 cc 1/8"	2" diameter x 7-1/2" long

Optional Equipment

Part Number	Description
PRSSG6195	Absorbent Refill Kit*
PRSMC-3	Mounting Clip with Screws (2 required)

Hydrocarbon Trap

The Model SG6130 Refillable Hydrocarbon Trap is designed to remove trace levels of organics from carrier gases such as Helium, Argon, Nitrogen, Hydrogen and Air. The Model SG6130 is packed with a baked coconut shell based activated carbon to effectively remove alcohols, aromatics, chlorinated hydrocarbons, ethers, hydrocarbons, ketones, mercaptans, and organic acids.

Service life of these traps will vary depending on the incoming hydrocarbon level in the carrier gas. However it is estimated that 1000 ft^3 (3-4 cylinders) of carrier gas can be purified before the absorbent needs replacing.

The all metal construction eliminates potential contamination from outgassing or diffusion (a phenomena commonly associated with plastic body traps).

SG6130 Hydrocarbon Trap

Standard Features

- Sintered type 316 stainless steel inlet and outlet filters protect against adsorbent migration
- Pre-purged and pressure tested with ultra-high purity helium to insure integrity

Specifications

- **Maximum Operating Pressure** 120 psig
- **Maximum Operating Temperature** 100 °F
- **Maximum Flow Capacity** 35 slpm at 120 psi
- **Dimensions** 2" OD x 14" long
- **Approximate Weight** 1 lb

Materials

- **Body and Caps** Aluminum
- **Seals** Viton®
- **Fittings** Brass
- **Filters (40 micron)** Type 316 Stainless Steel
- **Absorbent Material** Baked Coconut Shell Based Activated Carbon

Ordering Information

Part Number	Inlet and Outlet Connections
PRSSG6130-8	1/8" compression
PRSSG6130-4	1/4" compression

Optional Equipment

Part Number	Description
PRSSG6135	Absorbent Refill Kit*
PRSMC-3	Mounting Clip

* Kit contains enough adsorbent to refill two traps.

Purifiers/Filters

Oxygen Traps

Disposable Oxygen Trap

Praxair's SG6160 Series Oxygen Traps are designed to remove trace levels of Oxygen from carrier gases such as Argon, Carbon Dioxide, Carbon Monoxide, Helium, Hydrogen, Methane or Nitrogen. These traps are also ideal for use with argon-methane mixtures (i.e. P-5 or P-10 mixtures), commonly used with gas chromatographs utilizing electron capture detectors.

These traps incorporate a highly reactive, metal reagent, which is supported on an inert substrate, coupled with molecular sieves. Oxygen is removed by chemical reaction with the reagent to form a metal oxide. Oxygen levels can be effectively reduced to less than 5 ppb when starting levels are 10 ppm or less.

Service life of these traps will vary depending on the incoming Oxygen level in the carrier gas. However, it is estimated that when the starting Oxygen level is <10 ppm, the Model SG6160 can purify four cylinders (1200 ft^3) of carrier gas, while the Model SG6162 can typically purify thirty-five cylinders (10,500 ft^3) or more. We also recommend, where the application's flow rates permit, using these traps upstream of our SG6150 Series Indicating Oxygen Traps (below) to provide a visual indication of Oxygen breakthrough, thus alerting of the need to replace the trap.

Ordering Information

Part Number	Inlet and Outlet Connections	Oxygen Capacity	Maximum Flow Capacity
PRSSG6150-4	1/4" compression	22.5 cm^3 (30 mg)	10 slpm at 100 psi
PRSSG6150-8	1/8" compression	22.5 cm^3 (30 mg)	10 slpm at 100 psi

Optional Equipment

Part Number	Mounting Clip with screws
PRSMC-2	For Model SG6150

SG6160 Oxygen Trap

Specifications

- **Maximum Operating Pressure**
  Model SG6160: 125 psig
  Model SG6162: 125 psig
- **Efficiency**
  To <5 ppb Oxygen when inlet levels are 15 ppm or less
- **Oxygen Capacity**
  Model SG6160:
  260 cm^3 (345 mg)
  Model SG6162:
  3 liters (3200 mg)
- **Maximum Flow Capacity**
  Model SG6160:
  5 slpm nitrogen at 125 psig
  Model SG6162-4:
  20 slpm nitrogen at 80 psig
  Model SG6162-2:
  60 slpm nitrogen at 80 psig
- **Dimensions**
  SG6160: 1-1/4" D x 10" L
  SG6162: 2-3/8" D x 18" L
- **Approximate Weight**
  SG6160: 12 oz
  SG6162: 3 lb

Materials

- **Body**
  Aluminum
- **Inlet and Outlet Fittings**
  Brass
- **Filters (40 micron)**
  Type 316 Stainless Steel

Note: Oxygen Traps are not recommended as a replacement for the use of proper high purity gases. Rather, they are designed to provide additional protection from oxygen contamination which might result from system leaks or diffusion, or to achieve further reduction in oxygen impurity levels for extremely sensitive instrumentation or processes.

SG6150 Trap with
MC-2 Optional Mounting Clip

Glass Encased, Indicating Oxygen Traps

Models SG6150 and SG6151 Indicating Oxygen Traps are normally recommended for use downstream of non-indicating oxygen traps (where application flow rates permit) to provide a visual indication of oxygen breakthrough. Breakthrough is indicated via a color change in the adsorbent from gray to a deep brown. Because of their relatively small capacity, Indicating Oxygen Traps should be used by themselves only in low volume applications.

These traps consist of a silanized borosilicate glass tube filled with a molecular sieve base and activated getter material. Oxygen and a wide range of oxides react with the getter material to form a manganese oxide. The glass tube is enclosed in a clear plastic outer shell to provide protection from glass breakage while still allowing for a visual indication of the trap's condition.

Specifications

- **Maximum Operating Pressure:** 100 psig
- **Maximum Operating Temperature:** 100 °F
- **Efficiency**
  To <1 ppb oxygen with inlet levels of 10 ppm or less
- **Dimensions**
  SG6150:
  1-1/4" D x 9-1/2" L
  SG6151:
  1-3/8" D x 10-1/4" L
- **Approximate Weight**
  1 lb

Materials

- **Housing**
  Inner Tube:
  Silanized Borosilicate Glass
  Outer Tube:
  Polycarbonate Plastic
- **Seals**
  Zytel-A Nylon Resin
- **Fittings**
  Nickel-Plated Brass
- **Filters (40 micron)**
  Type 316 Stainless Steel

Ordering Information

Part Number	Inlet and Outlet Connections
PRSSG6160-4	1/4" compression
PRSSG6160-8	1/8" compression
PRSSG6162-2	1/2" compression
PRSSG6162-4	1/4" compression

Optional Equipment

Part Number	Mounting Clip
PRSMC-1	For Model SG6160
PRSMC-5-2	For Model SG6162 (Set of 2)

PRAXAIR
Making our planet more productive

Cryopreservation refers to frozen storage of biological materials at ultra-low temperatures to maintain their critical quality attributes. Cryopreservation is crucial for many types of cells, tissues, and cellular components in a wide variety of industries and academic disciplines. Praxair offers a world-class portfolio of cryogenic gases, equipment, and services to enable cryopreservation applications.

Risk mitigation efforts are important to avoid deterioration of precious samples stored in this manner. Key factors to consider include: type of refrigeration system, critical storage temperature, and cryogenic storage phase.

Ultra-low temperature freezers can be categorized as either mechanical, compressor-based systems or cryogenic systems. Mechanical systems remove heat by cycling a refrigerant through low and high pressures; they are generally operated between -70 and -86 °C. Cryogenic freezers exploit the refrigeration power of liquid nitrogen, which has a normal boiling point near -196 °C. Cryogenic freezers offer access to colder storage temperatures than mechanical freezers. Cryogenic freezers also fundamentally provide superior reliability and sample security. Cryogenic freezers do not rely on compressor systems that can fail due to electrical power disruption or mechanical breakdown. If for some reason liquid nitrogen could not be added to a cryogenic freezer, the highly insulated freezer will typically keep the samples below the target critical temperature for several days to weeks, depending on the quantity of liquid nitrogen in the freezer when the disruption occurred.

The optimal temperature for which biological samples should be stored will vary depending on a number of factors, including type of material, surrounding matrix, and the planned or potential use of the sample. In general, once a substance is in the solid phase (i.e., frozen), there is no such thing as too cold. Most degenerative processes are significantly slowed in cryogenic storage due to both the lower temperatures and the reduced molecular mobility. The glass transition temperature of water near -137 °C is typically identified as the critical temperature below which molecular mobility is dramatically reduced and degradation processes are effectively arrested. Cryogenic freezers generally operate at temperatures below the critical glass transition temperature. At warmer temperatures, such as -80 °C, degradation processes still operate, albeit slowly, and can have undesirable impact over timeframes of months or years.

Cryogenic freezers can be operated in a liquid-phase or vapor-phase mode. In the liquid-phase mode, the biological material is immersed in the liquid nitrogen. For vapor-phase operation, most freezers hold a reservoir of liquid nitrogen in the base of the freezer while the biological materials are positioned above the reservoir in the cold nitrogen vapor created by the continuous boiling of the liquid nitrogen. Today's high efficiency vapor-phase freezers are sufficiently insulated to maintain operating temperatures as low as -190 °C at the top of the freezer away from the liquid nitrogen reservoir. Storing in liquid phase provides the longest possible hold times and coldest possible temperature. Vapor-phase freezers are preferred for many applications, because they mitigate concerns over cross contamination and exposure of samples to liquid nitrogen.

With its deep experience and extensive capabilities, Praxair stands ready to support its customers in selecting and implementing the right cryopreservation systems for their needs.

Cryogenic Products

Cryopreservation Systems

Praxair has teamed with Chart MVE, the world's leading manufacturer of vacuum insulated products and cryogenic systems. Together we offer the broadest range of liquid nitrogen supply modes and storage solutions for cryopreservation of biological products. Ask about our "turn-key" liquid nitrogen supply systems that can provide your freezers with the most economical use of liquid nitrogen and the best return on your cryobiological storage investment.

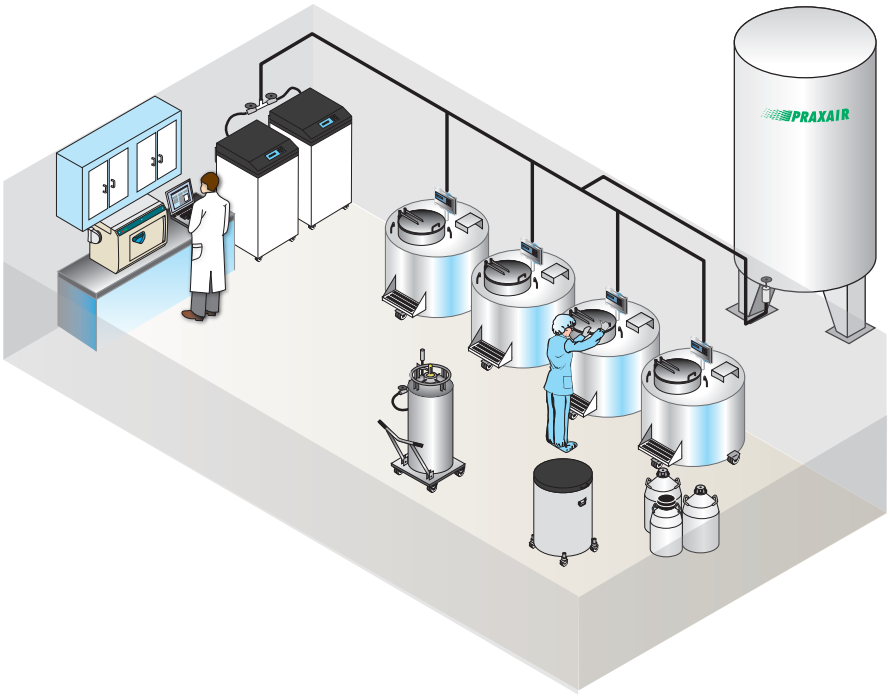
More than fifty years ago, Chart-MVE defined the standard for storage of biological materials at low temperatures. Today, Chart-MVE continues to exceed these standards. Industries from around the world look to Chart-MVE for excellence and innovation. Their solutions empower industries to better utilize cryogenic technology. Every Chart-MVE freezer is designed for optimum vacuum performance for the duration of its use. Chart-MVE freezers are engineered to hold and maintain specific temperatures, whether samples are in liquid or vapor.

By choosing a Chart-MVE cryogenic freezer, you are providing your samples a secure environment, free of the compressor breakdowns, noise, and heat associated with mechanical refrigeration systems.

A turn-key system from Praxair and Chart further provides a robust, efficient, and user-friendly means of delivering liquid nitrogen to the freezer. Chart-MVE products meet worldwide standards of excellence such as CE, MDD, UL, IATA, TGA, and ISO 9001. Factory tested to ensure reliability in the field, Chart-MVE vessels are backed by one of the strongest and longest warranties in the industry.

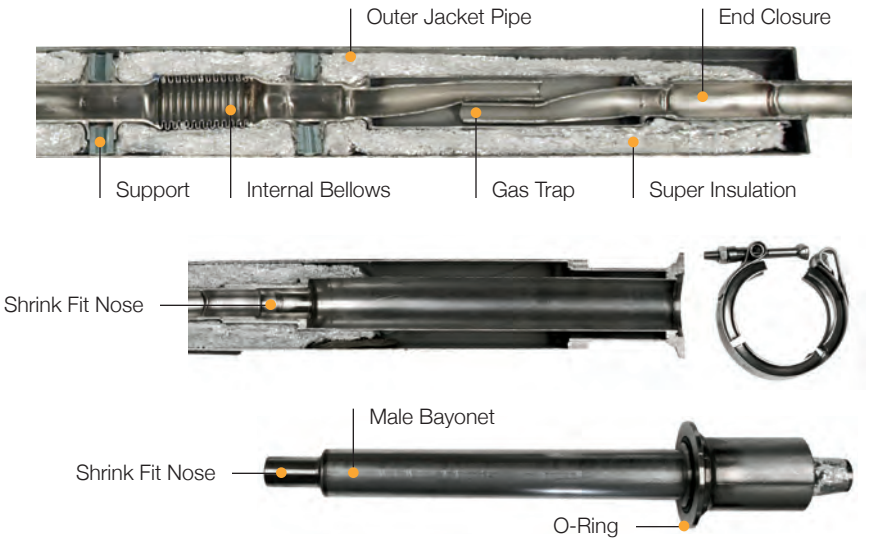
Warranties that Surpass Industry Standards

- Two (2) year warranty on all equipment (parts and labor).
- Three (3) year vacuum warranty on CryoSystem Series freezers and Vapor Shippers.
- Five (5) year vacuum warranty on all stainless steel freezers, aluminum SC and XC Series freezers, and aluminum Lab Series dewars.



Please contact your nearest Praxair location to inquire about turn-key vacuum-jacketed pipe installations.

Cutaway Section of Vacuum-Jacketed Piping



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MVE Variō™ Series Freezers

MVE Variō Series freezers maintain a user-selected temperature between -20 °C and -150 °C. The Variō Pro controller regulates the flow of liquid nitrogen through a cryogenic heat exchanger within the freezer to achieve the desired operating temperature throughout the interior sample space (+ / - 5 °C). The nitrogen vapor also purges frost and moisture to keep the sample space dry.

The Variō freezers offer a superior alternative to conventional compressor-based ultra-low temperature freezers operating near -80 °C. Since the Variō freezers utilize the vaporization of liquid nitrogen for refrigeration, their power consumption is very low, typically less than 1% compared to leading compressor-based freezers.

In addition, Variō freezers provide improved sample security by avoiding issues related to mechanical breakdown of compressors and by enclosing the samples in a highly insulated environment that holds the samples below their critical temperature for days if the liquid nitrogen supply is depleted. Variō freezers can also be operated at much colder temperatures than compressor-based systems to provide additional assurance for sample preservation.

Variō freezers are available in select geographies. Please ask your Praxair representative for more information.

	MVE Variō 1536P	MVE Variō 1539R
Maximum Storage Capacity		
1.2 & 2 ml Vials, (Internally Threaded)	36400	39000
Number of Racks, 100 cell boxes	24	26
Number of Racks, 25 cell boxes	16	16
Number of Stages per Rack	13	13
Performance		
Temperature Range	-20 °C to 150 °C	-20 °C to 150 °C
LN_2 Usage at -80 °C, liters/day	9	9
Power consumption, (cont.) W	8	8
Unit Dimensions		
Neck Opening, inch (mm)	17.5 (445)	17.5 (445)
Usable Internal Height, inch (mm)	28.8 (732)	28.8 (732)
Inner Diameter, inch (mm)	38.5 (978)	38.5 (978)
Overall Height, inch (mm)	61.3 (1556)	61.3 (1556)
Door Width Requirement*, inch (mm)	42.0 (1067)	42.0 (1067)
Weight Empty, lb (kg)	690 (313)	690 (313)

* Minimum width required for vessel to pass through opening. Footprint may vary.

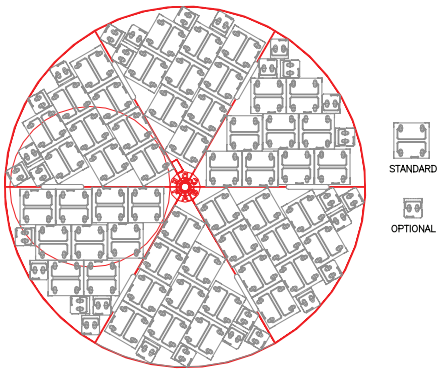
	MVE Variō 1536P			MVE Variō 1539R		
Blood Bag Capacities						
	Total Bags	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**
791 OS/U (25 ml)	3080	7	440	2786	7	398
Compact (25 ml)	4338	9	482	3924	9	436
4R9951 (50 ml)	1488	6	248	1446	6	241
4R9953 (250 ml)	812	4	203	768	4	192
4R9955 (500 ml)	608	4	152	576	4	144
DF200 (200 ml)	496	4	154	488	4	122
DF700 (700 ml)	256	4	64	204	4	66

Two Year Standard Warranty • Five Year Vacuum Warranty

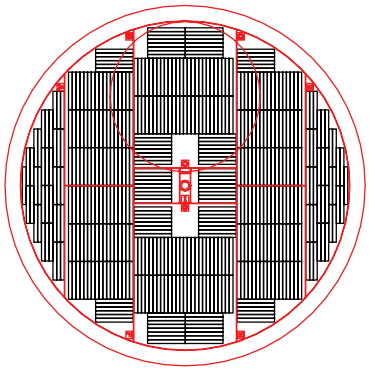
Cryogenic Products

Cryogenic Storage Freezers

Example Rack Layouts



Square Rack Layout



4R9951 Layout

Ask your Praxair representative about sample racks or other cryogenic accessories.

	MVE Varió 1879P	MVE Varió 1881R	MVE Varió 1894R
Maximum Storage Capacity			
	79950	81900	94500
	54	60	60
	30	12	12
	13	13	15
Performance			
	-20 °C to 150 °C	-20 °C to 150 °C	-20 °C to 150 °C
	12	12	15
	8	8	8
Unit Dimensions			
	25.0 (635)	25.0 (635)	25.0 (635)
	29.5 (749)	29.2 (741)	34.2 (868)
	56.0 (1422)	54.8 (1391)	54.8 (1391)
	62.1 (1577)	61.3 (1556)	66.3 (1683)
	60.0 (1524)	60.0 (1524)	60 (1524)
	1606 (728)	1721 (781)	1721 (781)

	MVE Varió 1879P			MVE Varió 1881R			MVE Varió 1894R		
Blood Bag Capacities									
	Total Bags	Bags/ Frame	No. of Frames	Total Bags	Bags/ Frame	No. of Frames	Total Bags	Bags/ Frame	No. of Frames
	5866	7	838	5628	7	804	6432	8	804
	8622	9	958	9414	9	1046	11506	11	1046
	2952	6	492	2940	6	490	3920	8	490
	1584	4	396	1608	4	402	2010	5	402
	1104	4	276	1240	4	310	1550	5	310
	960	4	240	984	4	246	1230	5	246
	504	4	126	544	4	136	680	5	136

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

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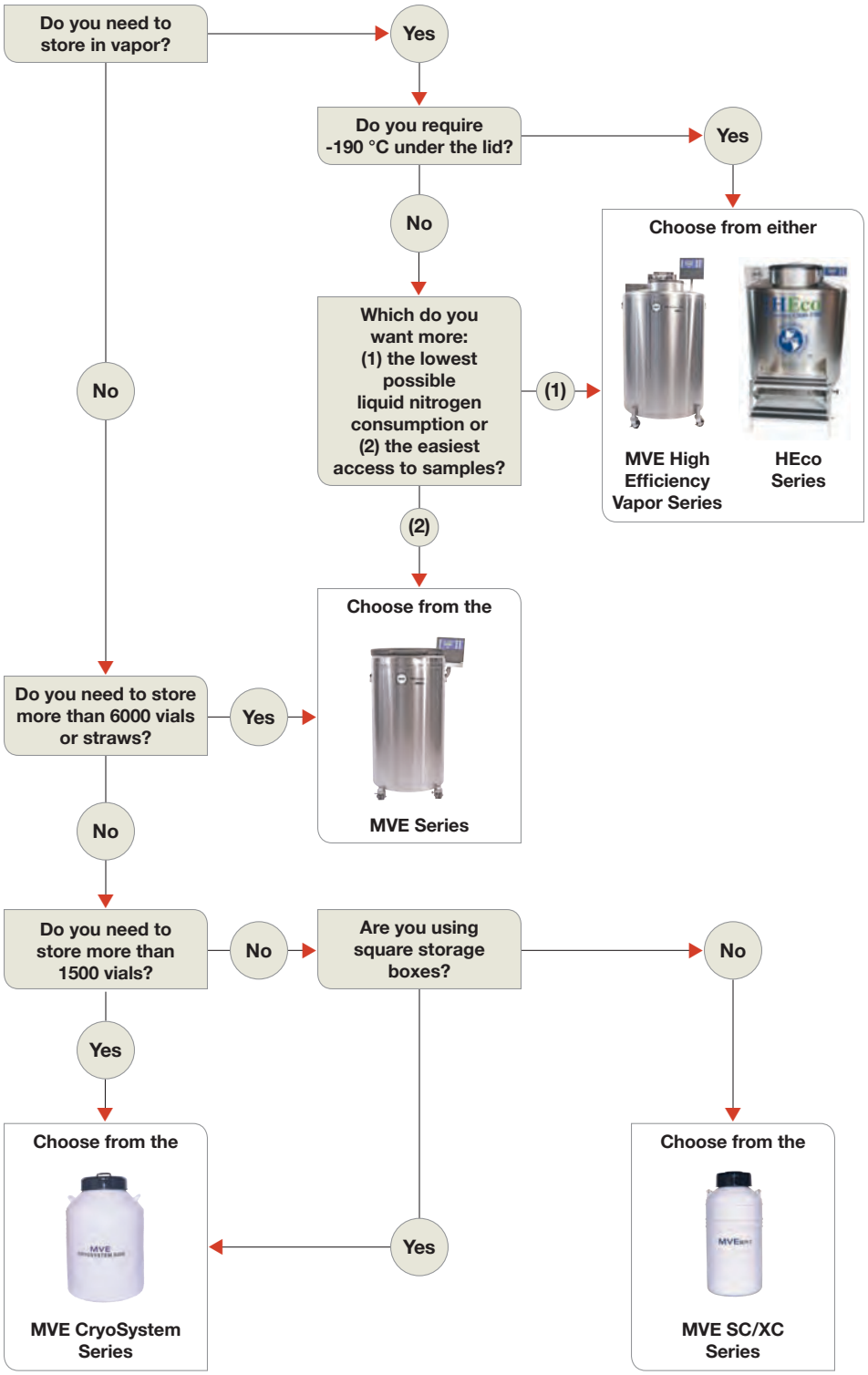
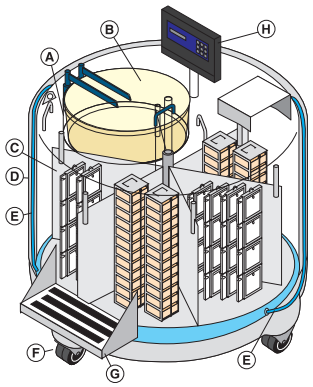
Freezer Selector Guide



MVE High Efficiency Vapor Series Freezer



A

Offset neck design to maintain -190°C in vapor storage and provide low liquid nitrogen consumption

B

Optimized lid design for enhanced durability

C

Rotating interior tray provides easy access to cryobiological samples

D

Low Maintenance, all-stainless steel construction

E

Annular filling lines reduce frost and ice formation near lid

F

Durable casters

G

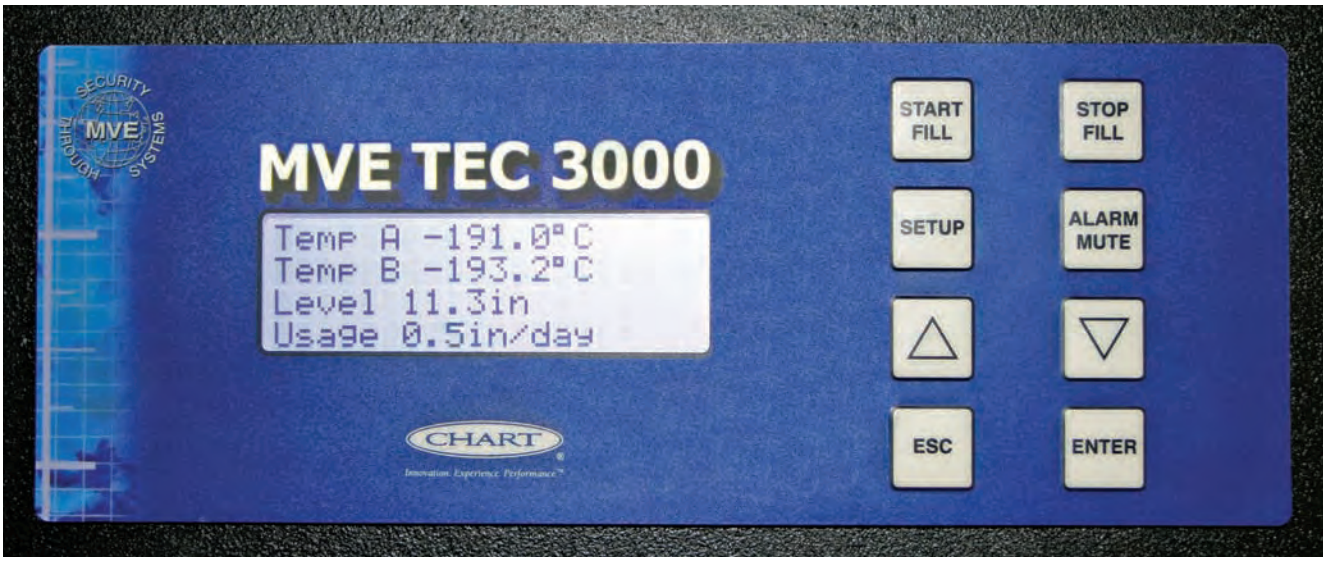
Two-level folding step on 1500 and 1800 series models provides lowest liftover height

H

Advanced TEC 3000 controller

Cryogenic Products

TEC 3000 Controller



TEC 3000 Controller

The TEC 3000 controller employs a variety of advanced features that enable the controller to monitor and control the environment inside a freezer with a high level of precision. The TEC 3000 controller is available for MVE HEco Series, MVE High Efficiency Series, MVE Series, MVE Stock Series, and MVE CryoSystem 6000 Full Auto freezers.

Features and Benefits

- Liquid nitrogen level management
- Automatic liquid nitrogen level control
- Two channel temperature measurement
- Multiple-use adjustable alarms
- Adjustable security/password system
- One fill-all fill capability (sequential or simultaneous)
- Timed filling
- Gas bypass
- Battery backup (optional)

Specifications

- **Level Measurement**
  - Sensor type – Dual port pressure transducer measurement accuracy +/- 0.5 in (+/- 13 mm) typical
  - Liquid usage feature
  - Two point calibration feature
- **Level Control**
  - Range 3-48 in (76-122 mm)
  - Control output – Fill solenoid valve
  - 24 VDC, 1.0 amp (maximum)
- **Temperature Measurement**
  - Two sensors, platinum RTD – Two wire element
    - Accuracy +/- 2.0°C full scale
    - Altitude compensation for accuracy
    - Full range calibration feature
    - Probe heater for high temperature alarm testing
- **Front Panel Display**
  - Backlit LCD readout, 4 row x 20 character
  - Level display – in, mm, %
  - Temperature display – °C, °F, or K
- **Standard Alarms**
  - Low level alarm
  - High level alarm
  - Low temperature (probe A & B)
  - High temperature (probe A & B)
- **Standard Alarms,** ***continued***
  - Full time alarm
  - Power failure (remote only)
  - Lid open alarm
  - Usage warning and alarm
  - Temperature calibration alarm (probe A & B)
  - Bypass sensor failure
  - Bypass time
  - Bypass sensor calibration
  - Power failure (audible, visual and remote alarms)
  - Low battery voltage
- **Alarm Output**
  - Both visual and audible alarms
  - One global remote alarm relay
  - Four discrete remote contacts
    - Temp A high
    - Low level
    - High level
    - Low battery (optional when equipped with battery backup)
- **Controller Features**
  - Communication interface – Serial communication RS485/ASCII/MODBUS
  - Memory – Stores time and date stamp information on the controller's 30,000 most recent events

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MVE HEco Series Freezers

The MVE HEco Series freezers provide best-in-class liquid nitrogen utilization efficiency. The streamlined liquid nitrogen plumbing system and included vacuum-jacketed transfer hose significantly reduce liquid nitrogen transfer losses. In addition, the MVE HEco freezers enclose all electronics and plumbing beneath hinged work surfaces at the top of the freezer. These work surfaces provide convenient locations to place a rack, box, or other item. The MVE HEco freezers are intended for vapor-phase sample storage with the samples placed above a liquid nitrogen reservoir at the base of the unit. These freezers provide -190 °C temperatures at the top boxes in the storage racks. MVE cryogenic storage freezers provide industry-leading storage density, hold time, and sample security.

	MVE HEco 815P-190	MVE HEco 818P-190	MVE HEco 819P-190
Maximum Storage Capacity			
1.2 and 2 ml Vials, (Internally Threaded)	15600	18200	19500
Number of Racks, 100 cell boxes	12	12	12
Number of Racks, 25 cell boxes	4	4	4
Number of Stages per Rack	12	14	15
Performance			
LN2 Capacity, liters	370	420	463
LN2 Capacity Under Tray, liters	52	55	55
Unit Dimensions			
Neck Opening, inch (mm)	12.5 (317)	12.5 (317)	12.5 (317)
Usable Internal Height, inch (mm)	26.6 (676)	30.7 (78)	34.5 (877)
Inner Diameter, inch (mm)	28.8 (731)	28.8 (731)	28.8 (731)
Overall Height, inch (mm)	49.5 (1257)	53.9 (1370)	57.70 (1465)
Door Width Requirement*, inch (mm)	32.0 (813)	32.0 (813)	32.0 (813)
Weight Empty, lb (kg)	475 (215)	495 (225)	515 (234)
Weight Liquid Full**, lb (kg)	1134 (514)	1168 (530)	1340 (608)

* Minimum width required for vessel to pass through opening. Footprint may vary.
** Without inventory

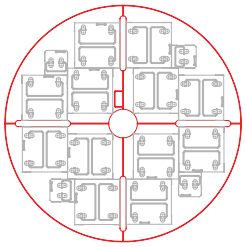
	MVE HEco 815P-190			MVE HEco 818P-190			MVE HEco 819P-190		
Blood Bag Capacities									
	Total Bags	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**
791 OS/U (25 ml)	1224	6	204	1632	7	128	1836	9	204
4R9951 (50 ml)	768	6	128	896	7	128	1024	8	128
4R9953 (250 ml)	416	4	104	416	4	104	520	5	104
4R9955 (500 ml)	304	4	76	304	4	76	380	5	76
DF200 (200 ml)	236	4	59	236	4	59	295	5	59
DF700 (700 ml)	–	–	–	–	–	–	–	–	–

Two Year Standard Warranty • Five Year Vacuum Warranty

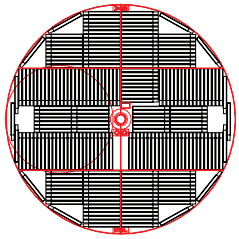
Cryogenic Products

Cryogenic Storage Freezers

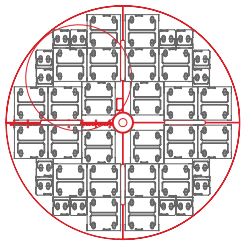
Example Rack Layouts



Square Rack Layout
HEco 800 Series



4R9951 Layout (R)
HEco 1500 Series



Square Rack Layout
HEco 1800 Series

Ask your Praxair representative about sample racks or other cryogenic accessories.

	MVE HEco 1536P-190	MVE HEco 1539P-190	MVE HEco 1542R-190	MVE HEco 1879P-190	MVE HEco 1892P-190	MVE HEco 1894R-190
Maximum Storage Capacity						
	36400	39200	42000	79950	92250	94500
	24	24	26	54	54	60
	16	16	16	30	30	12
	13	14	14	13	15	15
Performance						
	730	797	797	1745	1770	1770
	115	133	133	318	295	295
Unit Dimensions						
	17.4 (442)	17.5 (445)	17.5 (445)	24.7 (627)	24.7 (627)	24.7 (627)
	28.8 (732)	30.8 (782)	30.8 (782)	29.5 (749)	34.5 (876)	34.2 (868)
	38.5 (978)	38.5 (978)	38.5 (978)	56.0 (1422)	56.0 (1422)	54.7 (1389)
	54.7 (1389)	63.3 (1607)	63.3 (1607)	63.7 (1618)	68.6 (1742)	68.6 (1742)
	42.0 (1067)	42.0 (1067)	42.0 (1067)	60.0 (1524)	60.0 (1524)	60.0 (1524)
	700 (318)	720 (327)	720 (327)	1712 (781)	1721 (781)	1721 (781)
	2000 (907)	2140 (971)	2140 (971)	4830 (2191)	4875 (2211)	4875 (2211)

	MVE HEco 1536P-190			MVE HEco 1539P-190			MVE HEco 1542R-190			MVE HEco 1879P-190			MVE HEco 1892P-190			MVE HEco 1894R-190		
Blood Bag Capacities																		
	Total Bags	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**
	2905	7	415	3320	8	415	3184	8	398	5866	7	838	6704	8	838	6432	8	804
	1488	6	248	1736	7	248	1687	7	241	2952	6	492	3936	8	492	3920	8	490
	812	4	203	812	4	203	768	4	192	1584	4	396	1980	5	396	2010	5	402
	608	4	152	608	4	152	576	4	144	1104	4	276	1380	5	276	1550	5	310
	496	4	124	496	4	124	488	4	122	960	4	240	1200	5	240	1230	5	246
	256	4	64	256	4	64	264	4	66	504	4	126	630	5	126	680	5	136

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

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MVE High Efficiency/Vapor Series -190 °C Freezers

There is a critical temperature for most biological samples that are cryopreserved. This critical temperatue is commonly estimated as the glass transition temperature of water near -137 °C. The long-term viability of frozen samples can be seriously compromised if stored above this temperature. Further, if the samples experience several transitions through this range in either thermal direction, deterioration may also occur. It is therefore important that the liquid nitrogen freezer maintain a lower temperature, even during sample loading and retrieval. Chart-MVE's approach to this problem was to improve the fundamental design of freezers used in vapor phase to achieve -190 °C even at the top of the freezer while the freezer lid is open. The resulting MVE High Efficiency/Vapor Series -190 °C freezers provide maximum storage density and the industry's longest hold times.

Ask your Praxair representative about sample racks or other cryogenic accessories.

	MVE 815P-190
Unit Capacities – Vials	
1.2 and 2 ml Vials, (Internally Threaded)	15600
Number of Racks, (100 cell boxes)	12
Number of Racks, (25 cell boxes)	4
Number of Stages per Rack	12
Performance	
LN2 Capacity, liters	370
LN2 Capacity Under Vapor Storage Platform, liters	52
Unit Dimensions	
Neck Opening, inch (mm)	12.5 (317)
Useable Internal Height, inch (mm)	26.6 (676)
Inner Diameter, inch (mm)	28.8 (731)
Overall Height, inch (mm)	49 (1245)
Outer Diameter, inch (mm)	32 (813)
Footprint, inch (mm)	33.19 x 32 (843 x 813)
Depth of Extended Step, inch (mm)	–
Weight Empty, lb (kg)	475 (215)
Weight Empty, lb (kg)	1134 (514)

	MVE 815P-190		
Blood Bag Capacities			
	Total Bags	**Bags/ Frame**	**No. of Frames**
791 OS/U (25 mL)	1224	6	204
4R9951 (50 mL)	768	6	128
4R9953 (50 mL)	416	4	104
4R9955 (50 mL)	304	4	76
DF200 (200 mL)	236	4	59
DF700 (700 mL)	–	–	–

Two Year Standard Warranty • Five Year Vacuum Warranty

Cryogenic Products

Cryogenic Storage Freezers

	MVE 818P-190	MVE 819P-190	MVE 1536P-190	MVE 1539P-190	MVE 1542R-190
Unit Capacities – Vials					
	18200	19500	36400	39200	42000
	12	12	24	24	26
	4	4	16	16	16
	14	15	13	14	14
Performance					
	420	463	756	797	797
	55	55	133	133	113
Unit Dimensions					
	12.5 (317)	12.5 (317)	17.5 (445)	17.5 (445)	17.5 (445)
	30.7 (781)	34.5 (877)	28.8 (730)	30.8 (781)	30.8 (781)
	28.8 (731)	28.8 (731)	38.5 (978)	38.5 (978)	38.7 (983)
	53.3 (1353)	57 (1449)	54.9 (1393)	56.8 (1445)	56.9 (1445)
	32 (813)	32 (813)	42 (1066)	42 (1066)	42 (1066)
	33.19 x 32 (843 x 813)	33.19 x 32 (843 x 813)	46.1 x 42 (1172 x 1066)	42 x 46.1 (1066 x 1172)	43.6 x 46.1 (1107 x 1172)
	–	–	7.94 (202)	7.9 (202)	7.9 (202)
	495 (225)	515 (234)	690 (313)	720 (327)	720 (327)
	1168 (530)	1340 (608)	2037 (924)	2140 (971)	2140 (971)

	MVE 818P-190			MVE 819P-190			MVE 1536P-190			MVE 1539P-190			MVE 1542R-190		
Blood Bag Capacities															
	Total Bags	Bags/ Frame	No. of Frames	Total Bags	Bags/ Frame	No. of Frames	Total Bags	Bags/ Frame	No. of Frames	Total Bags	Bags/ Frame	No. of Frames	Total Bags	Bags/ Frame	No. of Frames
	1632	8	204	1836	9	204	2905	7	415	3320	8	415	3184	8	398
	896	7	128	1024	8	128	1488	6	248	1736	7	248	1687	7	241
	416	4	104	520	5	104	812	4	203	812	4	203	768	4	192
	304	4	76	380	5	76	608	4	152	608	4	152	576	4	144
	236	4	59	295	5	59	496	4	124	496	4	124	488	4	122
	–	–	–	–	–	–	256	4	64	256	4	64	264	4	66

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

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MVE High Efficiency/Vapor Series 190

	MVE 1879P-190	MVE 1881R-190	MVE 1892P-190
Unit Capacities – Vials			
1.2 and 2 ml Vials, (Internally Threaded)	79950	81900	92250
Number of Racks, (100 cell boxes)	54	60	54
Number of Racks, (25 cell boxes)	30	12	30
Number of Stages per Rack	13	13	15
Performance			
LN2 Capacity, liters	1745	1745	1770
LN2 Capacity Under Vapor Storage Platform, liters	318	318	296
Unit Dimensions			
Neck Opening, inch (mm)	25 (635)	25 (635)	25 (635)
Useable Internal Height, inch (mm)	29.5 (749)	29.2 (741)	34.5 (876)
Inner Diameter, inch (mm)	56 (1422)	54.8 (1391)	56 (1422)
Overall Height, inch (mm)	62.1 (1577)	61.3 (1556)	67.1 (1704)
Outer Diameter, inch (mm)	60 (1524)	60 (1524)	60 (1524)
Footprint, inch (mm)	64.1 x 60 (1629 x 1524)	60 x 64.1 (1524 x 1629)	60 x 64.1 (1524 x 1629)
Depth of Extended Step, inch (mm)	15.2 (385)	15.2 (385)	15.2 (385)
Weight Empty, lb (kg)	1721 (781)	1721 (781)	1545 (701)
Weight Empty, lb (kg)	4875 (2211)	4830 (2192)	4803 (2179)

	MVE 1879P-190			MVE 1881R-190			MVE 1892P-190		
Blood Bag Capacities									
	Total Bags	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**
791 OS/U (25 mL)	5866	7	838	5628	7	804	6704	8	838
4R9951 (50 mL)	2952	6	492	2940	6	490	3936	8	492
4R9953 (50 mL)	1584	4	396	1608	4	402	1980	5	396
4R9955 (50 mL)	1104	4	276	1240	4	310	1380	5	276
DF200 (200 mL)	960	4	240	984	4	246	1200	5	240
DF700 (700 mL)	504	4	126	544	4	136	630	5	126

Two Year Standard Warranty • Five Year Vacuum Warranty

Cryogenic Products

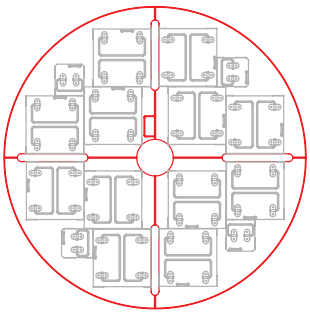
Cryogenic Storage Freezers

Ask your Praxair representative about sample racks or other cryogenic accessories.

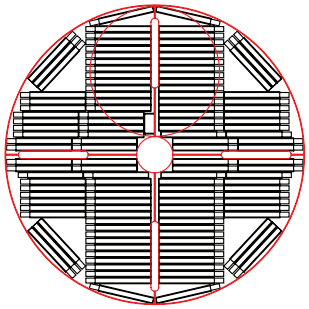
	MVE 1894R-190
	Unit Capacities – Vials
	94500
	60
	12
	15
	Performance
	1770
	296
	Unit Dimensions
	25 (635)
	34.2 (868)
	54.8 (1391)
	66.3 (1683)
	60 (1524)
	60 x 64.1 (1524 x 1629)
	15.2 (385)
	1721 (781)
	4875 (2211)

	MVE 1894R-190		
	Blood Bag Capacities		
	Total Bags	**Bags/ Frame**	**No. of Frames**
	6432	8	804
	3920	8	490
	2010	5	402
	1550	5	310
	1230	5	246
	680	5	136

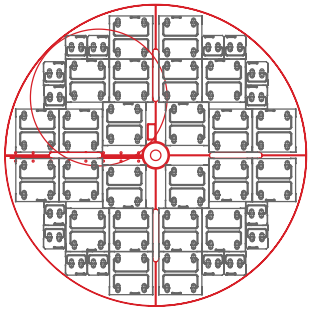
Rack Layouts



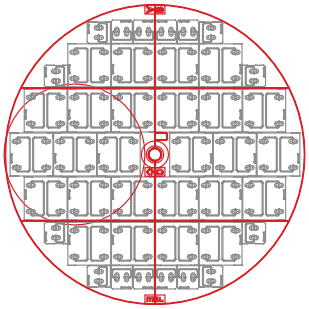
Square Rack Layout (P)
800 Series



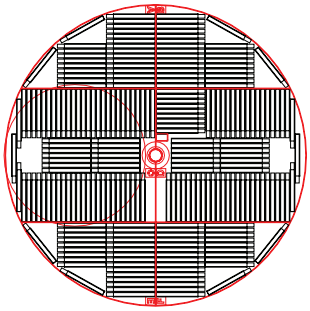
4R9951 Layout (P)
800 Series



Square Rack Layout (P)
1500 Series



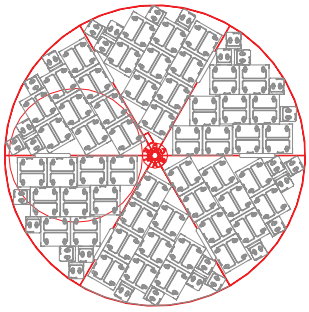
Square Rack Layout (R)
1500 Series



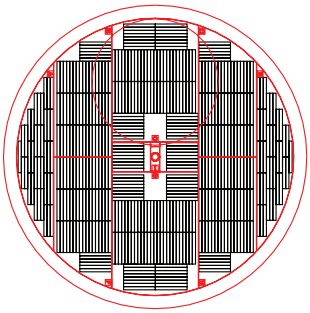
4R9951 Layout (R)
1500 Series

STANDARD

OPTIONAL



Square Rack Layout (P)
1800 Series



4R9951 Layout (R)
1800 Series

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

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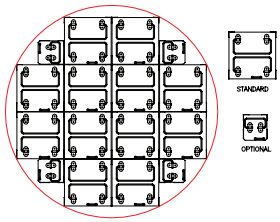
MVE Series

MVE Series freezers are designed to be used for either vapor or liquid storage. A wide neck opening provides easy access to samples, and stainless steel construction provides the most durable environment for their storage. With advanced features and storage from 3,200 to 39,000 vials, the MVE Series is a popular choice of laboratories worldwide.

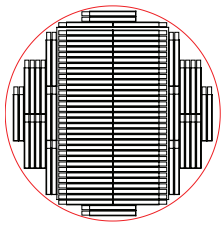
The MVE Series freezers are designed primarily for liquid phase storage. If vapor phase storage is required, request the vapor storage accessory package.

Ask your Praxair representative about sample racks or other cryogenic accessories.

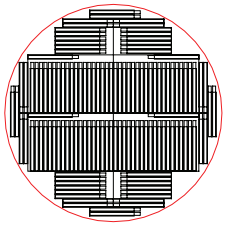
Rack Layouts



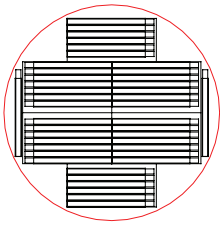
Square Rack Layout



4R9951 Layout



4R9953 Layout



DF700 Layout

	MVE 204	MVE 205
Maximum Storage Capacity		
Number of 1.2 and 2 ml Vials in Racks, (Internally Threaded)	3200	5200
Number of Racks, 100 vials	4	4
Number of Racks, 25 vials	–	–
Number of Stages per Rack	8	13
Performance		
LN2 Capacity, liters	65	95
Unit Dimensions		
Neck Opening, inch (mm)	16 (406)	16 (406)
Usable Height, inch (mm)	19.7 (502)	28.9 (735)
Overall Height, inch (mm)	30.8 (784)	41.6 (1059)
Outside Diameter, inch (mm)	18 (457)	20.4 x 18.5 (518 x 470)
Internal Diameter, inch (mm)	16 (406)	16 (406)
Footprint, inch (mm)	19.4 x 18.9 (492 x 479)	20.4 x 18.5 (518 x 470)
Weight Empty, lb (kg)	79 (36)	195 (88)
Weight Full, lb (kg)	195 (88)	365 (166)

	MVE 204			MVE 205		
Blood Bag Capacities (Liquid Phase Storage)						
	Total Bags	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**
791 OS/U (25 mL)	–	–	–	539	7	77
4R9951 (50 mL)	–	–	–	228	6	38
4R9953 (250 mL)	–	–	–	128	4	32
4R9955 (500 mL)	–	–	–	96	4	24
DF200 (200 mL)	–	–	–	80	4	20
DF700 (700 mL)	–	–	–	40	4	10

Two Year Standard Warranty • Five Year Vacuum Warranty

Cryogenic Products

Cryogenic Storage Freezers




	MVE 510	MVE 616	MVE 1426	MVE 1839
Maximum Storage Capacity				
	10400	16900	26650	39000
	7	12	18	28
	4	4	10	8
	13	13	13	13
Performance				
	166	240	388	673
Unit Dimensions				
	20.7 (527)	25.1 (638)	31.75 (806)	39.4 (1002)
	30 (762)	29.5 (749)	29.3 (745)	33.6 (854)
	46.7 (1185)	45.8 (1161)	42.4 (1076)	54 (1372)
	30.6 x 29.7 (778 x 754)	33.5 x 34.6 (852 x 878)	33.8 x 41.6 (858 x 1056)	46.1 x 48.3 (1172 x 1225)
	20.7 (527)	25.13 (638)	31.75 (806)	39.4 (1002)
	29.1 x 30.6 (740 x 778)	33.8 x 33.5 (859 x 852)	41.6 x 40 (1056 x 1017)	48.9 x 46.8 (1243 x 1187)
	281 (127)	320 (145)	490 (222)	750 (341)
	577 (262)	748 (339)	1181 (536)	1950 (885)

MVE 510			MVE 616			MVE 1426			MVE 1839		
Blood Bag Capabilities											
Total Bags	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**
882	7	126	1372	7	196	-	-	-	3968	8	496
420	6	70	612	6	102	924	6	154	1856	8	232
224	4	56	336	4	84	512	4	128	1010	5	202
160	4	40	248	4	62	424	4	106	770	5	154
128	4	32	200	4	50	336	4	84	854	7	122
68	4	17	116	4	29	168	4	42	532	7	76

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

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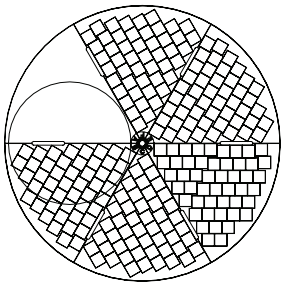
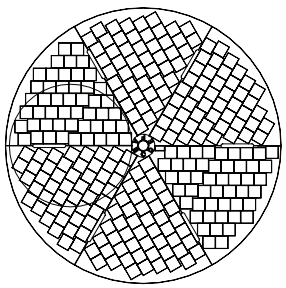
MVE Stock Series

MVE Stock Series Cryopreservation Systems are primarily designed for storage of either vials or straws on canes in liquid nitrogen. The tanks are built for long life, durability in service, and ergonomic sample retrieval, all of vital importance for this type of storage application. Dual lids on the MVE 1318 aid in sample removal while retaining critical temperatures inside the storage area. The rotating sample tray in the 1842P-150 allows for maximum storage space and easy access. All MVE Stock units are sample security and the ability to provide safe long-term storage for your valuable samples.

Rack Layouts



1877P-2T-150
Top Tier Capacity
245 Boxes



1877P-2T-150
Bottom Tier Capacity
294 Boxes

	MVE 103	MVE 808
Maximum Storage Capacity		
Number of 1.2 and 2 ml Vials in Racks, (Internally Threaded)	–	11700
Number of Racks, 100 vials	–	12
Number of Racks, 25 vials	–	4
Stages per Rack	–	9
Number of SUC-1 Canisters (2.5" x 2.5" x 11")	22	61
Number of 1.2 ml Vials on Canes	3168	8784
Number of 2 ml Vials on Canes	1760	4880
Number of 1/2 cc Straws, 10/Cane	6820	18910
Performance		
Liquid Nitrogen Capacity, liter	39	230
Unit Dimensions		
Neck Opening, inch (mm)	16 (406)	25 (634)
Usable Height, inch (mm)	12 (305)	22 (558)
Overall Height, inch (mm)	16.4 (415)	42.8 (1088)
Outside Diameter, inch (mm)	18 (457)	31 (787)
Internal Diameter, inch (mm)	16 (406)	28.3 (720)
Footprint, inch (mm)	19.4 x 18.9 (492 x 479)	35.2 x 31 (893 x 787)
Depth of Extended Step, inch (mm)	–	–
Weight Empty, lb (kg)	48 (22)	250 (114)
Weight Full, lb (kg)	117 (53)	660 (300)

Ask your Praxair representative about sample racks or other cryogenic accessories.

Two Year Standard Warranty • Five Year Vacuum Warranty

Cryogenic Products

Cryogenic Storage Freezers




	MVE 816P-2T-190	MVE 1318	MVE 1842P-150	MVE 1877P-2T-150
	Maximum Storage Capacity			
	–	20800	–	–
	–	24	–	–
	–	8	–	–
	–	8	–	–
	115	129	294	539
	16560	18576	42336	77616
	9200	10320	23520	43120
	35650	39990	91140	167090
	Performance			
	381	482	915	1400
	Unit Dimensions			
	12.5 (317)	35.5 (901)	25 (635)	25 (635)
	13 (330) per level	18.8 (479)	13 (332)	13 (330) per tray
	50 (1271)	47 (1193)	44.3 (1127)	58.2 (1479)
	32 (813)	42 (1067)	60 (1524)	60 (1524)
	28.7 (728) top tray 27.7 (702) bottom	39.6 (1007)	56.25 (1429)	56.25 (1429)
	32 x 33.2 (813 x 843)	42 x 42 (1067 x 1067)	60 x 60 (1524 x 1524)	64.2 x 60 (1629 x 1524)
	–	–	–	15.1 (385)
	475 (215) estimate	469 (213)	1167 (530)	1600 (726)
	1155 (524) estimate	1328 (602)	2798 (1270)	4094 (1857)

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

PRAXAIR
Making our planet more productive

MVE CryoSystem Series

The MVE CryoSystem Series freezers combine the benefits of low liquid nitrogen consumption with mid-range vial capacity to meet the diverse needs of today's professionals worldwide. The lightweight and low-space features of these containers make them the most economical units in their class. Chart-MVE cryogenic vessels are performance leaders through innovation, super insulation, and vacuum technology.

	CryoSystem 750	CryoSystem 2000	CryoSystem 4000	CryoSystem 6000
Maximum Storage Capacity				
Number of 1.2 and 2 ml Vials, (Internally Threaded)	750	2000	4000	6000
Number of Racks, 100 cell boxes	--	4	4	6
Number of Racks, 25 cell boxes	6	–	–	–
Number of Stages per Rack	5	5	10	10
Performance				
Liquid Nitrogen Capacity, liter	47.4	61	121	175
Static Evaporation Rate, liters/day*	0.39	0.85	0.99	0.99
Working Volume, liter	47	51	111	165
Normal Working Duration, days**	76	38	70	104
Unit Dimensions				
Neck Opening, inch (mm)	5 (127)	8.5 (216)	8.5 (216)	8.5 (216)
Overall Height, inch (mm)	26.5 (673)	27.25 (692)	38 (965)	37.75 (959)
Outer Diameter, inch (mm)	20 (508)	22 (559)	22 (559)	26 (665)
Weight – Empty, lb (kg)	42 (19)	58 (26.3)	81 (36.7)	103 (46.7)
Weight – Liquid Full, lb (kg)	126 (57)	182 (82.5)	300 (136)	425 (193)

* Static Evaporation Rate and static holding times are nominal. Actual rate and holding time will be affected by the nature of container use, atmospheric conditions, and manufacturing tolerances.

** Normal Working Duration is an arbitrary reference to estimate container performance under normal operating conditions. Actual working time may vary due to current atmospheric conditions, container history, manufacturing tolerances and any individual patterns of use.

Three Year Vacuum Warranty

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

Ask your Praxair representative about sample racks or other cryogenic accessories.

MVE CryoSystem 6000 Full Auto

The MVE CryoSystem 6000 Full Auto combines the compact efficiency of aluminum dewars with the monitoring and auto fill features of the TEC 3000 control system. The differential pressure-based level control allows this unit to easily be used for liquid or vapor storage with a -190° C top box temperature. The TEC3000 continually monitors and records temperature and LN2 levels, auto filling when needed, and providing audio/visual alarms with remote connectivity when necessary. Not having to manually fill this unit provides enhanced safety while also helping maintain a consistent temperature profile for vapor storage.

The CryoSystem 6000 Full Auto provides the convenience and security of high capacity stainless steel freezers for your average sized sample collection at a fraction of the price.

Features and Benefits

- Fully automatic LN2 level control and temperature monitoring
- Can be used for liquid or vapor storage
- Tracks and displays LN2 consumption
- 17 user-defined audio/visual alarms including High Temperature, Low Level, Liquid Usage, Fill Timeout, and more
- Remote monitoring and communication capabilities
- Electronically stores up to 10 years of unalterable, time-stamped data events for traceability and troubleshooting
- Transportable in emergencies or in the event of natural disasters

	CryoSystem 6000
Maximum Storage Capacity	
Number of Canisters	6
Number of 1.2 and 2 ml vials, 100/box	6000
Boxes per Rack	10
Performance	
LN2 Capacity, liter	175.0
Static Evaporation Rate* liters/day	4.0
Unit Dimensions	
Neck Opening, inch (mm)	8 (203)
Overall Height, inch (mm)	37.9 (963)
Outer Diameter, inch (mm)	26.5 (673)
Weight Empty, lb (kg)	103 (46.7)
Weight Full, lb (kg)	425 (193)

* Static evaporation rate and static holding time are nominal. Actual rate and holding time will be affected by the nature of container use, atmospheric conditions, and manufacturing tolerances.

Two Year Standard Warranty •
Three Year Vacuum Warranty

Conforms to MDD 93/42/EEC,
the Medical Device Directive for EU

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Making our planet more productive

MVE SC Series

Chart-MVE offers the widest range of compact aluminum storage tanks available on the market today. Over the past 50 years, Chart-MVE's product designs have improved through end-user input and evolved into a unique selection of units. The SC Series is designed for the user who has small capacity needs, but requires long-term storage and low liquid nitrogen consumption in a convenient light-weight package.

	SC 3/3	SC 8/5	SC 11/7
Maximum Storage Capacity			
Number of Canisters	6	6	6
Number of 1/2 cc Straws, 10/Cane	–	–	720
Number of 1/2 cc Straws, 1 Level Bulk	1122	1122	1122
Number of 1.2 & 2.0 ml Vials, 5/Cane	–	–	210
Performance			
Liquid Nitrogen Capacity, liter	3.6	8.4	11
Static Evaporation Rate, liters/day*	0.13	0.15	0.16
Normal Working Duration/day**	17	35	43
Unit Dimensions			
Neck Opening, inch (mm)	2.18 (55.4)	2.18 (55.4)	2.18 (55.4)
Overall Height, inch (mm)	16 (406)	18.5 (470)	21.6 (549)
Outside Diameter, inch (mm)	8.7 (222)	10.2 (260)	10.2 (260)
Canister Height, inch (mm)	5 (127)	5 (127)	11 (279)
Canister Diameter, inch (mm)	1.65 (41.9)	1.65 (41.9)	1.65 (41.9)
Weight Empty, lb (kg)	8 (3.6)	12 (5.3)	17 (7.7)
Weight Full, lb (kg)	14.4 (65)	27 (12.1)	36.6 (16.6)

* Static Evaporation Rate and static holding times are nominal. Actual rate and holding time will be affected by the nature of container use, atmospheric conditions, and manufacturing tolerances.

** Normal Working Duration is an arbitrary reference to estimate container performance under normal operating conditions. Actual working time may vary due to current atmospheric conditions, container history, manufacturing tolerances and any individual patterns of use.

Two Year Standard Warranty • Five Year Vacuum Warranty

Ask your Praxair representative about sample canisters or other cryogenic accessories.

Cryogenic Products

Cryogenic Storage Freezers

	SC 16/11	SC 20/20	SC 33/26	SC 36/32	Super 2
	Maximum Storage Capacity				
	9	6	6	6	6
	–	540	540	540	720
	1098	780	780	780	1122
	–	150	150	150	210
	Performance				
	16.4	20.5	33	36.5	24.5
	0.14	0.09	0.13	0.10	.085
	74	142	182	224	180
	Unit Dimension				
	2.18 (55.4)	2 (51)	2 (51)	2 (51)	2.18 (55.4)
	17.5 (444)	25.7 (652)	25.9 (657)	27.2 (690)	28.2 (716)
	17.2 (438)	14.5 (368)	18.2 (464)	18.2 (464)	14.5 (368)
	5 (127)	11 (279)	11 (279)	11 (279)	11 (279)
	1.5 (38)	1.5 (38)	1.5 (38)	1.5 (38)	1.65 (41.9)
	14 (6.4)	26 (11.8)	34 (15.4)	34 (15.4)	26.5 (10.5)
	43 (19.6)	62.5 (28.3)	93.4 (42.4)	100 (44.8)	68.4 (31)

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

PRAXAIR
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MVE XC Series

MVE XC Series tanks have capacities ranging from 700-5000 straws and 200 to 1300 vials. Manufactured to a world class level of excellence and backed by a 5 year vacuum warranty, these durable, lightweight units can be relied on to perform in the most demanding of environments. The XC Series is designed for the user who requires large capacity storage and low liquid nitrogen consumption in a convenient lightweight package.

	XC Millennium 20	XC 21/6	XC 22/5	XC 32/8	XC 33/22
Maximum Storage Capacity					
Number of Canisters	6	9	6	9	6
Number of 1/2 cc Straws, 10/Cane	720	–	2400	2520	1260
Number of 1/2 cc Straws, 1 Level Bulk	1122	3870	3666	3960	1764
Number of 1.2 and 2 ml Vials, 5/Cane	210	–	810	855	360
Number of 1.2 and 2 ml Vials, 25/Box	–	–	–	–	–
Performance					
Liquid Nitrogen Capacity, liter	20.5	21	22.4	32	33.4
Static Evaporation Rate, liters/day*	0.095	0.35	0.35	0.35	0.14
Normal Working Duration Days**	140	38	40	57	154
Unit Dimension					
Neck Opening, inch (mm)	2.18 (55.4)	3.5 (89)	3.81 (97)	3.81 (97)	2.75 (70)
Overall Height, inch (mm)	25.7 (652)	17.2 (438)	22 (559)	21.5 (546)	26 (660)
Outside Diameter, inch (mm)	14.5 (368)	18.2 (464)	14.5 (368)	18.2 (464)	18.2 (464)
Canister Height, inch (mm)	11 (279)	5 (127)	11 (279)	11 (279)	11 (279)
Canister Diameter, inch (mm)	1.65 (41.9)	2.75 (70)	3.09 (79)	2.62 (67)	2.22 (56)
Weight Empty, lb (kg)	23 (10.5)	30 (13.6)	26 (11.8)	30 (13.6)	34 (15.4)
Weight Full, lb (kg)	59.5 (27)	62.5 (28.3)	66 (30)	87 (39.5)	94 (42.5)

* Static Evaporation Rate and static holding times are nominal. Actual rate and holding time will be affected by the nature of container use, atmospheric conditions, and manufacturing tolerances.

** Normal Working Duration is an arbitrary reference to estimate container performance under normal operating conditions. Actual working time may vary due to current atmospheric conditions, container history, manufacturing tolerances and any individual patterns of use.

Two Year Standard Warranty • Five Year Vacuum Warranty

Ask your Praxair representative about sample canisters or other cryogenic accessories.

Cryopreservation Systems

Cryogenic Storage Freezers

	XC 34/18	XC 34/18 Plus*	XC 43/28	XC 47/11-6SQ	XC 47/11-6	XC 47/11-10
Maximum Storage Capacity						
	6	6	6	6 sq.	6	10
	2100	2100	1260	–	4500	3500
	3000	3000	1764	–	6216	5000
	630	630	360	–	1320	1050
	–	–	750	–	–	–
Performance						
	34.8	67.5	42.2	47.4	47.4	47.4
	0.18	0.31	0.14	0.39	0.39	0.39
	123	136	193	76	76	76
Unit Dimension						
	3.5 (89)	3.5 (89)	2.75 (70)	5 (127)	5 (127)	5 (127)
	26.6 (675)	37.5 (952)	26.4 (670)	26.5 (673)	26.5 (673)	26.5 (673)
	18.2 (464)	18.2 (464)	20 (508)	20 (508)	20 (508)	20 (508)
	11 (279)	11 (279)	11 (279)	–	11 (279)	11 (279)
	2.81 (71)	2.8 (71)	2.22 (56)	–	4 (102)	2.81 (71)
	34 (15.4)	45.9 (20.8)	36 (16.4)	42 (19)	42 (19)	42 (19)
	96 (43.5)	104.4 (47.3)	111 (50.5)	120.4 (54.6)	120.4 (54.6)	120.4 (54.6)

* Designed for vapor storage with elevated sample platform above liquid nitrogen. Sealed cannisters prevent liquid nitrogen ingress. Liquid nitrogen capacity below the sample platform is 32.7 L, overall inner height is 33.5 inches, and the distance from the sample platform to the top of the neck is 21 inches. "Weight Full" is determined with liquid nitrogen level at bottom of sample platform.

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

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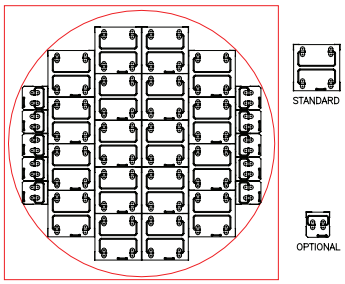
MVE Cabinet Series

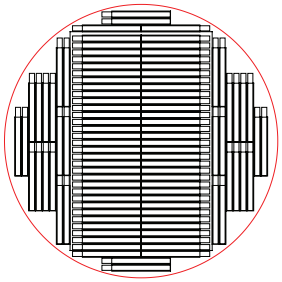
The MVE Cabinet Series freezers provide similar storage capacities and hold times compared to the corresponding MVE Series freezers but with a rectangular outer shell. These freezers are designed primarily for liquid phase storage. If vapor phase storage is required, request the vapor storage accessory package.

Ask your Praxair representative about sample racks or other cryogenic accessories.

Rack Layouts



Square Rack Layout



4R9951 Layout

	MVE 616C	MVE 1426C
Maximum Storage Capacity		
1.2 and 2 ml Vials, (Internally Threaded)	16900	26650
Number of Racks, 100 Ccell Boxes	12	18
Number of Racks, 25 Cell Boxes	4	10
Number of Stages per Rack	13	13
High Security Straw Capacity, 0.5 ml	50400	79800
Number of Canisters, 73 mm	60	95
Goblets/Canister: Straws/Goblet	5:168	5:168
Performance		
LN2 Capacity, liter	243	388
Unit Dimensions		
Neck Opening, inch (mm)	25.1 (638)	31.8 (806)
Usable Internal Height, inch (mm)	30.0 (762)	29.9 (759)
Overall Height, inch (mm)	41.4 (1051)	42.3 (1075)
Outside Diameter, inch (mm)	35.1 x 28 (892 x 711)	41.1 x 34.8 (1044 x 883)
Inner Diameter, inch (mm)	25.1 (638)	31.8 (806)
Door Width Requirement*, inch (mm)	35.1 x 28 (892 x 711)	41.1 x 34.8 (1044 x 883)
Weight Empty, lb (kg)	352 (160)	530 (240)
Weight Liquid Full**, lb (kg)	785 (356)	1198 (543)

* Without inventory
** Minimum width required for vessel to pass through opening. Footprint may vary. Contact Tech Service for detailed drawings.

	MVE 616C			MVE 1426C		
Blood Bag Capacities						
	Total Bags	**Bags/ Frame**	**No. of Frames**	**Total Bags**	**Bags/ Frame**	**No. of Frames**
791 OS/U (25 ml)	1372	7	196	2226	7	318
4R9951 (50 ml)	612	6	102	924	6	154
4R9953 (250 ml)	336	4	84	512	4	128
4R9955 (500 ml)	248	4	62	424	4	106
DF200 (200 ml)	200	4	50	336	4	84
DF700 (700 ml)	116	4	29	168	4	42

Two Year Standard Warranty • Five Year Vacuum Warranty

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

Cryogenic Products

Cryogenic Shipping and Transport

MVE CryoCube™

The MVE CryoCube provides an economical option for shipping or transporting frozen biological samples. The MVE CryoCube incorporates a hydrophobic compound that absorbs liquid nitrogen and provides a dry, -150 °C environment. Liquid nitrogen charging can be accomplished in less than one hour. After charging, the unit remains at -150 °C for five days. The MVE CryoCube can be shipped or handled in any orientation without impacting temperature or hold time.

Features

- Charges in under 1 hour
- Operates as a dry shipper
- -150° C temperature
- 5 day holding time
- Weighs less than 9 lb. charged
- Safe shipping in any orientation
- Safe for international shipping

	CryoCube™
Maximum Storage Capacity	
Number of Canisters	1
Number of 1/2 cc Straws, 1 Level Bulk	88
Number of 1/4 cc Straws, 1 Level Bulk	182
Number of 1.2 and 2 ml Vials, Bulk	6
Performance	
LN2 Capacity, (min) liter	2
Static Holding Time, days	5
Unit Dimensions	
Neck Opening, inch (mm)	1.4 (35)
Overall Height, inch (mm)	12 (305)
Outer Width, inch (mm)	12 (305)
Inner Canister, Height in. (mm)	5.25 (127)
Inner Canister, Diameter in. (mm)	1 (35)
Weight Empty, lb (kg)	5.25(1.8)
Weight Charged, lb (kg)	9 (4)

90 Day Standard Warranty

PDF Logger

The PDF Logger provides a simple means of monitoring the temperature of cryobiological materials during shipping and transportation. The easy-to-use “Transit” and “Arrived” buttons make initiating and receiving shipments fast and simple. The PDF Logger plugs directly into a computer USB port to automatically generate a report of temperature and alarm history in PDF format. The PDF Logger is factory calibrated and possesses a one year lifespan. The PDF Logger is available on its own, as part of a package including a mounting bracket and temperature probe, or installed on the cork and cover for select cryogenic storage equipment.

Specifications

- **Dimensions L x W x H in (mm)**
  3.7 x 1.6 x 0.5 (95 x 40 x 12)
- **Weight oz (g)**
  1.4 (40)
- **Temperature Range**
  -200 °C to +200 °C
- **Accuracy**
  ± 0.5 °C [-200 °C, -10.1 °C]
- **Resolution**
  0.1 °C
- **Display**
  Multifunction LCD, 23.5 x 23.5 mm
- **Case**
  ABS plastic
- **Battery**
  3.6V
- **Battery Life**
  400 days
- **Sensor**
  Pt100 3-wire class 0.5
- **Memory**
  16,000 data points
- **Interface**
  USB – PC Universal Serial Bus
- **Software Compatibility**
  Windows 7, VISTA, XP, Win2000, Win 98/ME
- **Configuration**
  LIBERO Configuration Utility – Free of charge on www.pdf-logger.com
- **Evaluation Report**
  Built-in PDF file generator that automatically establishes an evaluation file including graph. Complies to the ISO Standard 19005-1 Document Management for the long-term preservation of electronic documents
- **Compliance**
  FDA 21 CFR Part II, GMP, GLP

1 Year Warranty

MVE CryoShipper Series Featuring Advanced QWick™ Charge Technology

MVE CryoShippers are designed for the safe transportation of biological samples at cryogenic (-150 °C or colder) temperatures. Manufactured from durable, lightweight aluminum, they employ a hydrophobic compound which absorbs the liquid nitrogen to ensure spill-free shipping. Because the absorbent is hydrophobic, it also repels moisture and humidity, assuring maximum holding time and eliminating the necessity to dry units between uses. MVE CryoShippers feature Advanced QWick™ Charge Technology that enables charging with liquid nitrogen in less than 2 hours.

A protective shipping carton is available for all models (except the SC 20/12V). This carton protects the container from being placed on its side and helps withstand the rigors of transportation. These containers may be used to ship your samples with a "non-hazardous" classification throughout the world, thus reducing costs and helping to assure sample viability.

	SC 2/1V	SC 4/2V	SC 4/3V	SC 20/12V
Static Holding Time, days	8	13	21	85
Weight Empty, lb (kg)	6.0 (2.7)	10.0 (4.5)	11.0 (5.0)	25.0 (11.3)
Weight Charged, Vapor, lb (kg)	8.0 (3.6)	15.5 (7.0)	17.0 (7.7)	43.0 (19.5)
Weight Full, Liquid, lb (kg)	9.0 (4.1)	20.0 (9.1)	21.0 (9.5)	56.5 (25.6)
Maximum Storage Capacity				
Number of Canisters	1	1	1	6
Number of 1/2 cc Straws, 10/Cane	–	280	120	540
Number of 1/2 cc Straws, 1 Level Bulk	88	440	210	780
Number of 1/4 cc Straws, 1 Level Bulk	182	938	452	1630
Number of 1.2 and 2 ml Vials, 5/Cane	–	95	40	150
Number of 1.2 and 2 ml Vials, 6/Cane	9	106	48	180
Number of Blood Bags Stored, 4R9953	–	–	–	–
Performance				
Liquid Nitrogen Capacity, liter	1.5	3.6	4.3	12.3
Static Evaporation Rate(1), liters/day	0.19	0.26	0.20	0.09
Unit Dimensions				
Neck Opening, inch (mm)	1.40 (35.0)	2.75 (70.0)	2.00 (51.0)	2.00 (51.0)
Overall Height, inch (mm)	13.5 (343)	18.4 (468)	19.4 (492)	25.7 (652)
Outside Diameter, inch (mm)	7.25 (184)	8.70 (222)	8.70 (222)	14.50 (368)
Canister Height, inch (mm)	5.0 (127)	11.0 (278)	11.0 (278)	11.0 (278)
Canister Diameter, inch (mm)	1.20 (31)	2.62 (67)	1.81 (46)	1.50 (38)

(1) Without inventory

Three Year Vacuum Warranty

Cryogenic Products

Cryogenic Shipping and Transport

Features and Benefits

- Durable, tamper-proof lid design
- High strength neck tube reduces liquid nitrogen loss
- Strong, lightweight aluminum construction
- Advanced chemical vacuum retention system
- Hydrophobic liquid nitrogen absorbent system
- Charges in less than two hours

IATA Shipper -150 °C Specimen Transport

MVE's IATA Dewar has been independently tested and approved to meet current UN and IATA regulations concerning the transportation of potentially infectious substances. Test data and reports are available upon request.

Note: All other models of MVE Vapor Shippers can be legally transported by air (when shipping specimens that are not classified as or known to be potentially infectious).

	XC 20/3V[2]	Mini Moover	Cryo Moover	Cryo Shipper Mini	Cryo Shipper	Cryo Shipper XC	IATA
	16	14	12	7	10	14	14
	25.0 (11.3)	9.0 (4.1)	30.5 (13.8)	23 (10.4)	26.2 (11.9)	33.0 (15.0)	33.0 (15.0)
	43.0 (19.5)	12.5 (5.7)	37 (16.8)	32 (14.5)	41.3 (18.7)	50.5 (22.9)	50.5 (22.9)
	38.4 (17.4)	15.5 (7.0)	87 (39.5)	45 (20.4)	54.5 (24.7)	73.0 (33.1)	73.0 (33.1)
	Maximum Storage Capacity						
	4 + 1 Center	1	7	–	1 Rack	–	Secondary Container
	2500/2000[2]	60	3080	–	–	–	–
	3750/3000[2]	88	4354	–	–	–	–
	7410/6000	185	–	–	–	–	–
	675/560[2]	20	945	–	–	–	–
	840/672[2]	24	1134	–	500	966 (Bulk)	–
	–	–	–	–	10	10	–
	Performance						
	6.8	2.9	4.2	5.9	8.5	10.0	11.8
	0.35	0.20	0.35	0.84	0.85	0.85	0.80
	Unit Dimensions						
	3.81 (96.7)	1.40 (35.0)	3.80 (97.0)	8.50 (216.0)	8.50 (216.0)	8.50 (216.0)	8.50 (216.0)
	25.0 (635)	19.5 (495)	22.0 (558)	20.0 (508)	21.5 (546)	23.0 (584)	24.0 (610)
	14.50 (368)	7.20 (184)	18.30 (464)	11.60 (295)	14.50 (369)	15.00 (381)	15.00 (381)
	11.0 (278)	11.0 (278)	11.0 (278)	–	–	12.5 (317.5)[3]	8.5 (215)
	3.20 (80)	1.20 (31)	3.10 (79)	–	–	–	7.50 (190)

[2] Optional center absorbent added to center canister to extend hold time to 3 weeks.
[3] Usable height

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

PRAXAIR
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MVE Lab Series

The MVE Lab Series cryogenic liquid dewars get their name from their acceptance in laboratories and medical facilities worldwide. These high-efficiency, super insulated dewars are the most convenient, economical way to store and dispense liquid nitrogen. Many lab units can be fitted with pouring spouts, pressurized dispensing devices, or dippers to aid in the transfer of liquid nitrogen.

	LAB 4	LAB 5	LAB 10
Maximum Storage Capacity			
Net Capacity, liter	4	5	10
Performance			
Static Evaporation Rate, liters/day	0.19	0.15	0.18
Unit Dimensions			
Neck Opening, inch (mm)	1.4 (35.5)	2.18 (56)	2.18 (56)
Usable Height, inch (mm)	7.8 (198)	10.5 (266)	13.5 (343)
Overall Height, inch (mm)	16.8 (426)	18.2 (462)	21.5 (546)
Outside Diameter, inch (mm)	7.3 (185)	8.8 (222)	10.3 (260)
Internal Diameter, inch (mm)	5.5 (139)	6.5 (165)	8.3 (210)
Weight Empty, lb (kg)	6 (2.7)	8 (4)	12 (5.4)
Weight Full, lb (kg)	13 (6)	17 (8)	31 (14)

Accessories

Manual discharge device

Pouring spouts

Two Year Standard Warranty • Five Year Vacuum Warranty

	LAB 20	LAB 30	LAB 50
	Maximum Storage Capacity		
	20	32	50
	Performance		
	0.18	0.22	0.49
	Unit Dimensions		
	2.18 (51)	2.5 (64)	2.5 (64)
	13.7 (348)	14.9 (378)	22 (559)
	24.5 (622)	24 (610)	30.5 (775)
	14.5 (368)	17 (432)	17 (432)
	11.4 (289)	14 (356)	14 (356)
	19 (9)	25 (11.4)	31 (14)
	55 (25)	82 (37.2)	120 (54.4)

Accessories

Rigid and swivel dipper

Conforms to MDD 93/42/EEC, the Medical Device Directive for EU

MVE CryoCyl Series

CryoCyl 35 and 50 Series

- Same rugged design as the larger CryoCyl units
- Operates at 22 psig
- Complete with pressure and liquid level gauge

Model		
Size	35	50
Pressure	LP	LP
Part Number	1098D671	1098D663
Capacity		
Liquid, gross	35 liters	50 liters
Liquid, net	N/A	N/A
Performance		
NER (LN2)	4%/day	4%/day
Dimensions and Pressure Ratings		
Diameter, inch (cm)	16 (40.6)	16 (40.6)
Height, inch (cm)	34.75 (88.27)	40.5 (103.51)
Empty Weight, lb (kg)	85.5 (38.78)	98.5 (47.68)
Relief Valve Setting, psig (bar)	22 (1.5)	22 (1.5)
DOT/CTC Rating	N/A	N/A

Five Year Vacuum Warranty,
90 Days Parts

MVE Research Dewars

MVE Research Dewars provide a convenient means of transporting liquid nitrogen within a laboratory or facility. The units possess all stainless steel construction for durability and vacuum insulation for long liquid nitrogen hold times. MVE research dewars come with an insulated lid and carrying handle.

Features

- All stainless steel construction
- Insulated lid
- Wide mouth for easy access
- Convenient carrying handle (except 0.5L)
- Meets laboratory safety requirements that prohibit glass lined dewars

	RD-6	RD-3	RD-2	RD-1	RD-1W	RD-0.5
Performance						
LN2 Capacity, liter	6	3	2	1	1	0.5
Handle	yes	yes	yes	yes	yes	no
Unit Dimensions						
Neck Opening, inch (mm)	7.3 (185)	7.3 (185)	3.9 (99)	3.3 (84)	3.9 (99)	2.6 (66)
Inner Diameter, inch (mm)	7.3 (185)	7.3 (185)	3.9 (99)	3.3 (84)	3.9 (99)	2.6 (66)
Outer Diameter, inch (mm)	7.8 (198)	7.8 (198)	4.8 (122)	4.3 (109)	4.8 (122)	3.4 (86)
Usable Internal Height, inch (mm)	10.6 (269)	6.3 (160)	7.1 (180)	6.2 (157)	6.1 (155)	7.1 (180)
Overall Height, inch (mm)	11.8 (300)	7.5 (191)	12.3 (312)	9.1 (231)	7.0 (178)	8.0 (203)
NER without cover, liter/hr	0.4	0.2	0.1	0.1	0.2	0.1

All-Stainless Steel Liquid Transfer Hoses

Offering Outstanding Flexibility, Performance, Safety, and Service Life

Liquid transfer hoses are designed to be highly flexible in cryogenic applications. Constructed with close pitch stainless steel corrugated bore, specially woven stainless steel braid, and exterior floppy armor casing. ISO 10380 certified for bend cycle life. Available with machined stainless steel tube ends and flares for CGA 295 inert applications and CGA 440 oxygen applications. Options include 3/8" MPT one end.

Designed to be highly flexible in cryogenic applications

Features

- Type 321 stainless steel – 4.8 inch dynamic bend radius
- 1,160 psi working pressure – 6,104 psi burst pressure
- T-321 stainless steel core
- Special stainless steel braid
- Stainless steel armor casing for safety
- Stainless steel flare or NPT ends
- Cleaned and bagged to CGA standards
- Standard lengths are 36" and 72". Custom lengths available upon request

Optional Features

- **Stainless Steel Cryogenic Elbows**
  Long radius design relieves bending stress on hose

Stainless steel cryogenic elbows

Ordering Information

Part Number	Description
PRSUF21-IN3	Inert service, 3 ft – CGA 295 each end
PRSUF21-IN3NP	Inert service, 3 ft – 3/8" MPT one end
PRSUF21-IN6	Inert service, 6 ft – CGA 295 each end
PRSUF21-IN6NP	Inert service, 6 ft – 3/8" MPT one end
PRSUF21-OX3	Oxygen service, 3 ft – CGA 440 each end
PRSUF21-OX3NP	Oxygen service, 3 ft – 3/8" MPT one end
PRSUF21-OX6	Oxygen service, 6 ft – CGA 440 each end
PRSUF21-OX6NP	Oxygen service, 3 ft – 3/8" MPT one end

Note: Standard lengths are 36" and 72". Custom lengths are available upon request. Specify length with part number (Example PRSUNSUF21-OX3)

Custom lengths are available upon request

Optional Equipment

Part Number	Option	Description
PRSSSL-CR90-8	SS Cryogenic Elbows, CGA 295 M x F ends 6	1/2" Tube
PRSSSL-CR90-10	SS Cryogenic Elbows, CGA 440 M x F ends 6	5/8" Tube

Standard Assembly

Part Number	Description
PRSUF21IN4EPS	Inert service 4' cryo hose with elbow and phase separator

LN2 Tx

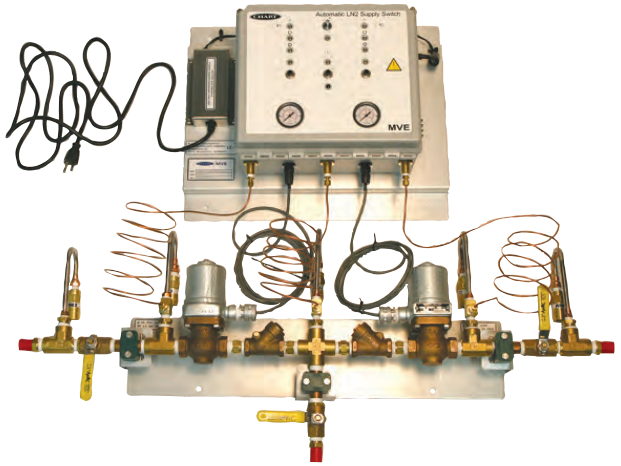
The LN2 Tx simplifies the transfer of liquid nitrogen from one open vessel to another. The LN2 Tx utilizes a pressurized nitrogen gas source (22-50 psig) to push the liquid nitrogen from the target vessel and transfer it to the receiving vessel at a flow rate up to approximately 2 liters per minute. Use of the LN2 Tx avoids the hassles and safety risks of lifting and pouring heavy vessels holding liquid nitrogen.

Unit Dimensions

Rigid Aluminum Tube Length, ft (m)	4 (1.2)
Flex Hose Length, ft (m)	8 (2.4)
Overall Weight, lb (kg)	8.5 (3.9)
Minimum Neck Opening, in (mm)	3.5 (89)

MVE Automated High Capacity LN2 Supply Tank Switch

The MVE Automated High Capacity LN2 Supply Tank Switch enables automatic switching from a primary liquid nitrogen supply tank to a secondary liquid nitrogen supply tank when the primary tank is empty. The system monitors pressure in the transfer line to determine when tank switching is necessary. The MVE Automated High Capacity LN2 Supply Tank Switch provides a means for helping ensure supply of liquid nitrogen to critical cryogenic applications, such as a biological storage freezer. A visual alarm indicates when the primary tank has been switched. Audible and visual alarms indicate when both tanks are empty.



Cryogenic Accessories

Phase separators enable liquid to be dispensed into non-pressurized environments with less chance of splashing

Part Number	Description
PRS10615869	Phase separator 1-5/8" diameter x 4" long
PRS10615877	Phase separator 1-5/16" diameter x 3" long
PRS10615885	Phase separator 1-11/16" diameter x 1-1/2" long
PRS10784443	T piece valve assembly

Safety Equipment

Part Number	Description
PRS9717119	Cryo gloves midarm medium
PRS9717129	Cryo gloves midarm large
PRS9717139	Cryo gloves midarm extra large
PRS9717149	Cryo gloves elbow length medium
PRS9717159	Cryo gloves elbow length large
PRS9717169	Cryo gloves elbow length extra large
PRS10464394	Cryo apron

Roller base

Liquid Nitrogen Low Level Alarms

Model 626

This unique controller has been designed to provide a complete working alarm system. This alarm provides protection during the time the probe is unplugged, or removed from the dewar. When the probe is removed from the dewar during a work function, simply press the work button. This will keep the alarm in a momentary standby mode (approximately 10 minutes). If the probe is not returned after 10 minutes, the alarm will slowly return to its full audible horn and activate the remote relay.

The Progressive Audible Horn allows the operator to remove the probe from the dewar without the unit going into an audible and a remote relay alarm. Pressing the Work/Mute button will lower the horn sound (which has been factory set). After 10 minutes the horn will gradually increase to maximum volume. This will alert the operator to place the probe back into the dewar, or press the Work/Mute button again.

Model 626 LN^2 Low Level Alarm, Small Dewar Lid Size

Features

- Low Level Alarm
- Work Mute Button
- Progressive Audible Horn
- Press to Test Remote Relay (5 seconds)
- Flashing Alarm LED (normal no flashing)
- Universal 9 volt AC Wall Transformer (117 volt/ option 220 volt)
- Open Probe Alarm
- Shorted Probe Alarm
- Remote Alarm Output

Ordering Information

Part Number	Description
PRS 626	Liquid Nitrogen Low Level Alarm

Model 610

Model 610 is a battery operated liquid nitrogen (LN2) Low Level Alarm, providing up to 5 days of alarm on one (1) charge. This handy unit is also equipped with a built-in battery charger, a bracket designed to protect the unit during fill and provide easy access to the front plate.

Model 610 battery operated LN_2 Low Level Alarm

Features

- Built-in battery charger
- Continuous alarm (5 days on full battery charge)
- Universal 9 volt AC wall transformer/option 220 volt
- Open or shorted probe protection
- Push to Test button (battery and alarm can both be tested at the same time)
- Easy Installation
- Compact size (3-1/4" x 5-1/2" x 1-3/4")
- Complete with mounting bracket to fit on the unit handle

Ordering Information

Part Number	Description
PRS 610	Battery Operated Liquid Nitrogen Low Level Alarm

Cryogenic Products

Contolled Rate Freezing Systems

Model 9010

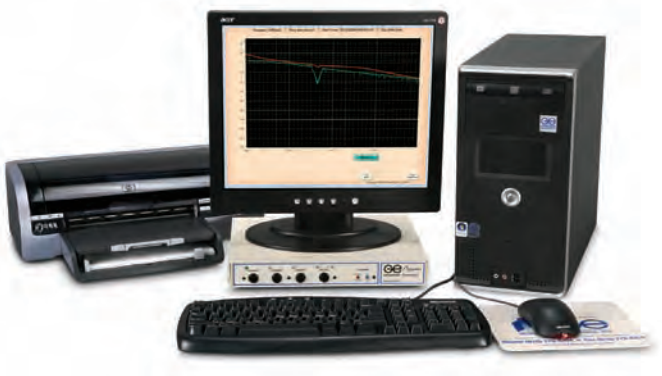
The Model 9010 Control Rate Freezing system gives you full onscreen computer-controlled cryogenic freezing. The GE-WINCRYO software is very user-friendly, but does not limit the programming capability. The system has five (5) sample programs, preset in memory, which may be used or changed to fit your needs but not limit your ability to make manual changes during a run from the keyboard.

One of the programming features that is important to the viability of the product is the ability to use the sample temperature in programming.

The Model 9010 system has software installed into the most advanced computer which is available at the time of each order. The computer has MicroSoft® Windows XP Professional operating system installed. The freezing system may be used with any additional software except when operating in GE-WINCRYO. The 9010 system is also available in a laptop configuration.

The use of aluminum in the construction of the freezing chamber provides the ability to produce a constant temperature during a freeze run. We offer the following models:

- **Model 8710 –** top loading freezer.
- **Model 8754 –** front loading freezer.
- **Model 8760 –** front loading, dual valve control.



Model 9010 Control Rate Freezing System

Model 9010 System with laptop

Model 8710 top loading freezer

Model 8754 front loading freezer

Model 8760 front loading, dual valve control freezer

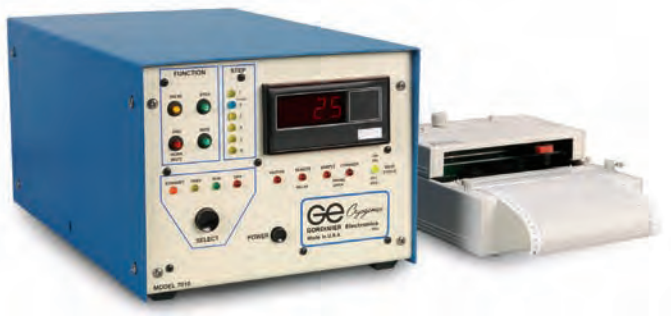
Model 7010

The Model 7010 cryogenic freezing controller is simple, versatile and works with amazing efficiency. Used along with GE freezing chambers, this state-of-the-art process controller is offered with a variety of preset programs on modular inserts that give you the ability to change freezing programs quickly and easily.

Each pre-programmed freezing program gives precise, accurate and complete repeatability with each freezing process. The strip chart recorder monitors the temperature of sample, chamber or both. The data is accurately recorded.

Features

- Plug-in modular programs
- Accurate monitoring with digital readout
- Exceptional performance
- Compact and easy to use
- Automatically controlled freezing and drying cycles
- Strip chart recorder
- Scanner with ability to monitor both chamber and sample
- Sample probe – using sample temperature in programming



Model 7010 Cryogenic freezing controller

For more information on Controlled Rate Freezing Systems contact your local Praxair representative or call, 1-877-PRAXAIR.

PRAXAIR
Making our planet more productive

Gas Cylinder Heater

The HT series of heaters combines the function of an insulating blanket and heater. The blanket is constructed of a fire resistant impregnated fiberglass. The blanket maintains an approximate temperature of 94 °F (34 °C) on the lower third of the cylinder while an approximate temperature of 89 °F is maintained on the upper third. The heating element has been designed to self regulate its heat output, providing efficient use of electrical power, producing heat only when required.

Features and Benefits

- **Two inch chemical resistant insulated jacket**
  Long service life which can withstand up to 500 °F
- **Velcro Fastening**
  Ease of installation
- **Ten foot power cord**
  Convenient power supply
- **Unique heater design**
  Creates a convection
- Rated for hazardous Class 1, Division 1 Groups C & D. (Group "B" available as a special order)

Ordering Information

Part Number	Power Rating	Description
PRS2015-AS	50 WattsFits	Praxair cylinder size AS (8" x 48")
PRS2015-K	50 Watts	Fits Praxair cylinder size K (9" x 51")
PRS2015-FX	100 Watts	Fits Praxair cylinder size FX (15" x 43")

Recommended Options

Part Number	Description
PRS121-ASK	12" Rubber Floor Mat, fits Praxair cylinder size AS and K
PRS121FX	12" Rubber Floor Mat, fits Praxair cylinder size FX
PRS400	Cylinder Wall Bracket

Accessories

Stand Alone Alarms

Two and Ten Point Alarms

Praxair's alarm boxes are typically used in conjunction with pressure switches to provide a means of visual and acoustic monitoring of alarm signals. Standard operating conditions are indicated by an illuminated green lamp. The lamp and horn check button allows for self checking. If one or more alarm signals are triggered, acoustic and visual signals are also emitted.

Two Point Alarm
PRS0010003

Specifications

- **Power Supply**
  110v
- **Connection System**
  Two wire
- **Effective Direction**
  (NC) Normally Closed
- **Signal Lamp**
  LED

Ordering Information

Part Number	Description
PRS00100003	Two Point Alarm
PRS00100006	Ten Point Alarm
PRS00100003IB*	Intrinsic Safety Barriers

* Must be purchased separately when being used in flammable gas service.

Intrinsic Safety Barrier
PRS00100031B

Indicating Pressure Switches

The 550 series of switches are designed to provide pressure monitoring for a wide variety of applications. These two inch stainless steel gauges are capable of operating in conjunction with Praxair's alarms.

Specifications

- **Gauge**
  2" dial
- **Connections**
  ¼" MNPT lower mount
- **Operating Temperature**
  -40 °F to 140 °F
  (-40 °C to 60 °C)
- **Electrical Load**
  - Maximum switching voltage 24 VDC/VAC
  - Maximum load 10 W
  - Maximum current 0.5A

Materials

- **Gauge**
  Bourdon Tube, 316L

Ordering Information

Part Number	Pressure Range
PRS550-1000	0-100 psi
PRS550-1001	0-300 psi
PRS550-1002	0-600 psi
PRS550-1003	0-1000 psi
PRS550-1004	0-3000 psi
PRS550-1005	0-6000 psi

Warning: Intrinsic safety barriers must be purchased when gauges are being used in flammable service.

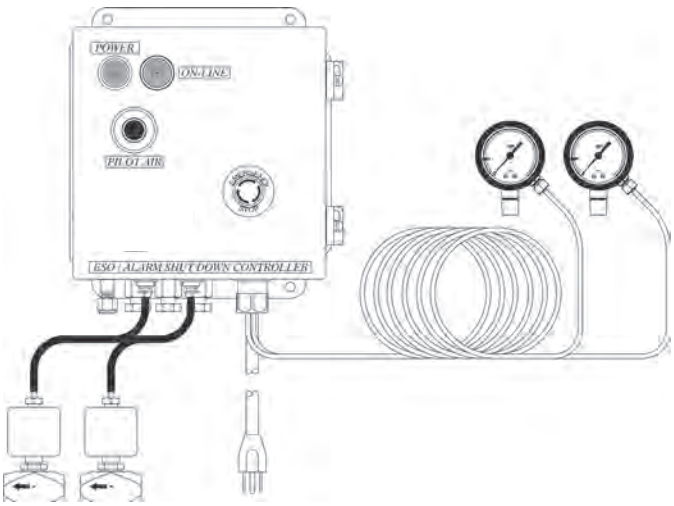
Emergency Shutdown Systems (ESS)

At Praxair, a commitment to safety is a critical consideration in all of our activities. Helping maintain a level of safety for our employees and our customers is one of our top priorities. To help our customers achieve this goal, we have developed a series of emergency shutdown system controllers. These systems can be used in a wide variety of applications and are tailored to fit most applications.

A typical shutdown system can include any of the components and configurations shown below. We also can custom engineer a system to meet your requirements.

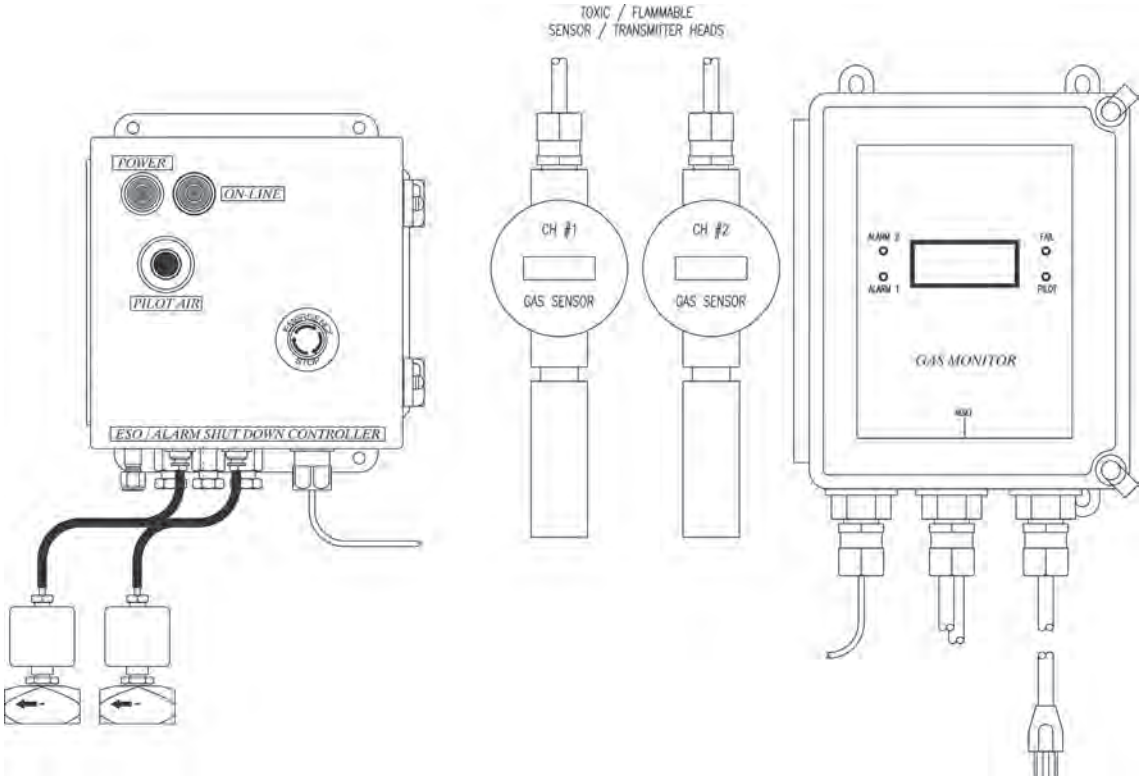
The most common uses of these types of systems include Toxic, Flammable and Corrosive Gas and Liquid Services, where the unintentional release of gas or liquid could result in personnel injury or equipment damage.

To find out more about Emergency Shutdown Systems or to have one engineered to fit your specific needs, please contact your Praxair representative or call 1-877-PRAXAIR.



Pneumatic Shut Down Controller

Use discrete pressure set points to shut down a pneumatic process valve or close the entire system with ESO push button.



Emergency Gas Shutdown System

Close individual or all pneumatic process valves with gas detection control signal, or with master ESO button. Used with highly toxic, flammable, or where oxygen displacement monitoring is required. System can be expanded to control up to eight control valves. Requires use of a Praxair approved gas detection system and controller.

Facilities Requirements

- 100/115/220V ~ ± 10%, 50/60Hz, 0.2/A0.2/0.1 24 V ± 10%, 0.5A VDC
- Main supply voltage fluctuations not exceeding ± 10% of nominal
- DC supply voltage fluctuations not exceeding ± 10% of nominal

Pilot Air Nitrogen

- Required 80-90 psig to supply ESO/Alarm Shut Down Controller. 1/4" OD poly tubing to connect ES controller pneumatic signals to process valves (normally closed/fail safe valves required)

Accessories

Diaphragm and Miniature Needle Valves

533 Series Diaphragm Valves

The 533 Series diaphragm valves are ideal for use as the primary flow control in high purity or corrosive gas systems. Springless design and low wetted surface area combine to minimize particle generation and the completely swept path minimizes entrapment. The unique design of the 533 Series allows low torque operation with gas flow in either direction. Flow control is accomplished with the multi-turn model while the 1/4 turn model is quick acting and indicates on/off position.

Specifications

- **Maximum Inlet Pressure**
  3500 psig
- **Temperature Range**
  -40 °F to 140 °F (-40 °C to 60 °C)
- **Helium Leak Integrity**
  1 x 10^{-8} scc/sec
- **Cv**
  0.17
- **Weight**
  0.66 lb (0.3 kg)

533 Series Diaphragm Valve

Materials

- **Bodies and Fittings**
  Brass barstock or 316L stainless steel
- **Diaphragms**
  Elgiloy®
- **Seats**
  KEL-F®
- **Seals**
  Metal to metal

Ordering Information – Series PRS533ABC

A	B	C
Flow Control	**Material**	**Inlet Connections**
0: Multi-Turn 1: 1/4 Turn	2: Brass 4: 316L Stainless Steel 9: Chrome-Plated Brass	0: 1/4" FPT x 1/4" FPT 2: 1/4" Tube x 1/4" Tube 3: 1/4" MPT (Extended Leg) x 1/4" Tube 4: 1/4" MPT x 1/4" MPT 8: 1/4" MPT (Extended Leg) x 1/8" Tube 9: 1/4" MPT (Extended Leg) x 1/4" FPT

For example, a PRS533140 is a bare body, 316L stainless steel diaphragm valve controlled by a 1/4 turn handle.

500 Series Miniature Needle Valves

The 500 Series miniature needle valves are forged from brass, 316L stainless steel, or Monel®. They are designed for fine flow control in a variety of applications in the chemical process and petroleum industries, as well as laboratories and hospitals. The ground and polished stem and Teflon® packing make them suitable for controlling the flow of liquids or gases from vacuum to 3000 psig.

Specifications

- **Maximum Inlet Pressure**
  3000 psig (210 bar)
- **Temperature Range**
  -65 °F to 450 °F (-54 °C to 232 °C)
- **Weight**
  0.7 lb (0.3 kg)

500 Series

Materials

- **Bodies and Fittings**
  Brass barstock or 316L stainless steel
- **Diaphragms**
  Elgiloy®
- **Seats**
  KEL-F®
- **Seals**
  Metal to metal

Ordering Information – Series 500

Part Number	End Fittings	Body	Stem	Packing
PRS5500067	1/8" MPT x 1/8" MPT	Forged Chrome-Plated Brass	303 Stainless Steel	Teflon®/Chrome-Plated Brass
PRS5339002	1/4" MPT x 1/4" MPT	Forged Brass	303 Stainless Steel	Teflon®/Brass
PRS5553225	1/4" MPT x 1/4" MPT	Forged Chrome-Plated Brass	303 Stainless Steel	Teflon®/Chrome-Plated Brass
PRS5339304	1/4" MPT x 1/4" MPT	Forged 316 Stainless Steel	316 Stainless Steel	Teflon®/316 Stainless Steel
PRS5339408	1/4" MPT x 1/4" MPT	Forged Monel®	Monel®	Teflon®/Monel®
PRSSG5434	1/4" MPT x 1/4" MPT	Brass Angle	303 Stainless Steel	Teflon®/Brass
PRSSG5425	1/4" MPT x 1/4" MPT	Stainless Steel	316 SKtainless Steel	Teflon®/Stainless Steel

Diffusion-Resistant, Diaphragm Seal, Excess Flow Shut-off Valves (FS Series)

FS Series Excess Flow Shut-Off Valves are designed to automatically shut-off the delivery of gas in a line if the flow exceeds a preset limit. They are commonly used as a safety device to protect a system from excess flow in the event of equipment failure or to protect personnel and property in the event of a line rupture. The capability of operating from 10 to 3500 psi allows them to be used either in high or low pressure applications.

The Excess Flow Limit Valve is a 2-position valve. In the "Open (Reset)" position, the valve provides a direct passage from inlet to outlet. In the other position, "Auto Shut-Off", the valve is set to sense the flow and automatically shuts off the passage if the flow exceeds a preset value (flow limit). The valve will stay shut-off until it has been reset.

Six flow ranges are offered and the actual flow shut-off value for each range is dependent upon the operating pressure. The graph below indicates, for each range, the relationship between operating pressure and the actual flow limit. It is suggested that the range selected provide shut-off at 2-6 times the anticipated flow rate to allow for short term flow surges not connected with equipment failure.

Note: Piping systems, cylinders and other equipment can contribute rust or other particulate contamination that could cause the device to fail. Therefore it is highly recommended that all gases be filtered before they enter the FS Series Valve.
See pages E•333 and E•334 for additional information.

FS Series Valve

Standard Features

- Type 316L stainless steel construction provides maximum corrosion resistance
- Elgiloy® diaphragm minimizes diffusion of air into valve and maintains gas purity
- High pressure design allows for use between a gas cylinder and the inlet to a pressure regulator
- Threaded holes on bottom of valve permit front panel mounting

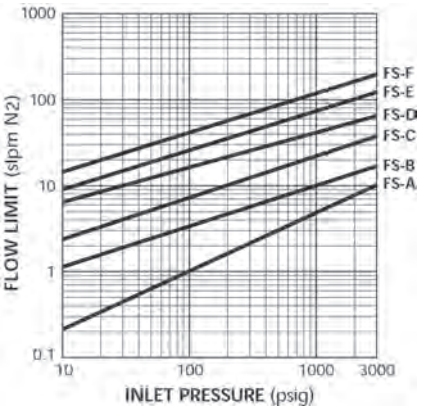
Optional Features

- High purity inlet filter provides protection from particulate contamination

Specifications

- **Maximum Inlet Pressure**
  3500 psig
- **Minimum Inlet Pressure**
  10 psig
- **Differential Pressure at Flow Limit**
  Ranges A , B, C and D: 5 psig
  Ranges E and F: 12 psig
- **Operating Temperture Range**
  -10 °F to +150 °F
- **Inlet and Outlet Connections**
  1/4" NPT female
- **Approximate Weight**
  10 oz.
- **Surface Finish**
  15-20 Ra micro inch or less

Flow Range Selection Chart



Materials

- **Body**
  Type 316L stainless steel bar stock
- **Bonnet**
  Type 316L stainless steel
- **Seat**
  PCTFE
- **Diaphragm**
  Elgiloy® (or equivalent)
- **Spring**
  Hastelloy C-22®
- **Other Metal Parts Exposed to Gas**
  Type 316L stainless steel

Ordering Information

Part Number	Nominal Flow Limit Value for Nitrogen at 1000 psig Inlet	Nominal Flow Limit Value for Nitrogen at 30 psig Inlet
PRSFS-A-190	4.8 slpm	0.4 slpm
PRSFS-B-190	9.1 slpm	1.7 slpm
PRSFS-C-190	21.8 slpm	3.9 slpm
PRSFS-D-190	39.5 slpm	9.0 slpm
PRSFS-E-190	72.3 slpm	14.4 slpm
PRSFS-F-190	120.6 slpm	22.5 slpm

CV5600 Series Check Valves

Check valves ensure that gases or liquids flow in one direction only. When used on the outlet line of pressure regulators, they prevent back flow of fluids into the regulator. When used in cylinder pigtails, they prevent gas flow from one cylinder into another on the same manifold. They also stop air from entering the pigtail and manifold when a cylinder is removed.

These check valves are bubble-tight against any back pressure.

Note: Check valves are also available housed within a CGA connection – see page E•382 for additional information.

1/4" Compression Check Valve

1/4" FPT Check Valve

Specifications

- **Approximate Weight**
  4 oz

Materials

- **Spring/Poppet**
  Type 316 Stainless Steel

Ordering Information

Part Number	Maximum Operating Pressure (psig)	Cracking Pressure (psig)	Connections Inlet	Outlet	Body Material	Seal Material	Flow Coefficient (Cv)
PRSCV5651	3000	1.0	1/4" NPT male	1/4" NPT male	Brass	Viton®	0.5
PRSCV5652	3000	1.0	1/4" NPT female	1/4" NPT female	Brass	Viton®	0.5
PRSCV5653	3000	1.0	1/4" compression	1/4" compression	Brass	Viton®	0.5
PRSCV5654	3000	5.0	1/4" NPT male	1/4" NPT female	Brass	Viton®	0.5
PRSCV5660	6000	1.0	1/4" NPT male	1/4" NPT male	316 SS	Buna-N®	0.5
PRSCV5661	6000	1.0	1/4" NPT male	1/4" NPT male	316 SS	Viton®	0.5
PRSCV5663	6000	1.0	1/4" NPT female	1/4" NPT female	316 SS	Viton®	0.5
PRSCV5665	6000	1.0	1/4" NPT female	1/4" NPT female	316 SS	Buna-N®	0.5
PRSCV5666	6000	1.0	1/4" compression	1/4" compression	316 SS	Viton®	0.5
PRSCV5667	3000	1.0	1/4" compression	1/4" compression	316 SS	Kalrez®	0.42
PRSCV5668	6000	1.0	1/4" compression	1/4" compression	316 SS	Buna-N®	0.5
PRSCV5669	6000	5.0	1/4" NPT male	1/4" NPT female	316 SS	Viton®	0.5
PRSCV5670	3000	1.0	1/4" compression	1/4" NPT male	Brass	Viton®	0.5
PRSCV5672	6000	1.0	1/4" compression	1/4" NPT male	316 SS	Viton®	0.5
PRSCV5674	3000	1.0	1/4" male vacuum	1/4" male vacuum	316L SS	Viton®	0.36
PRSCV5675	3000	1.0	1/4" male vacuum	1/4" male vacuum	316L SS	Kalrez®	0.36

RV5571, RV5572, RV5580 Series Relief Valves

Relief valves are commonly used downstream of pressure regulators to protect the regulator, delivery pressure gauge and downstream system from damage due to overpressurization caused by a regulator failure. When properly installed they may be used with hazardous gases because they have 1⁄4" NPT outlets which permits vented gas to be piped to a safe disposal system.

RV5571 Relief Valve

RV5572 Relief Valve

RV5580 Relief Valve

Specifications

- **Reseat Pressure**
  70% of set pressure
- **Inlet Connection**
  1/4" MPT
- **Outlet Connection**
  Models RV5571, RV5580:
  1/4" FPT
- **Outlet Connection**
  Model RV5572: 1/4" MPT
- **Approximate Weight**
  Model RV5580:
  8 oz
  Models RV5571 and RV5572:
  2 oz

Ordering Information – Relief valves, adjustable prior to installation

Part Number	Adjustable Range (psig)	Body Material	Seal Material	Flow Coefficient (Cv)
PRSRV5571-20	10-20	Brass	Viton®	0.37
PRSRV5571-100	20-100	Brass	Viton®	0.37
PRSRV5571-250	100-250	Brass	Viton®	0.37
PRSRV5571-500	250-500	Brass	Viton®	0.37

Ordering Information – Field adjustable relief valves

Part Number	Adjustable Range	Body Material	Seal Material	Flow Coefficient (Cv)
PRSRV5580-225	10–225	316 SS	Viton®	0.60
PRSRV5580-350	50–350	316 SS	Viton®	0.41
PRSRV5580-750	350–750	316 SS	Viton®	0.41
PRSRV5580-1500	750–1500	316 SS	Viton®	0.41
PRSRV5580-2250	1500–2250	316 SS	Viton®	0.41
PRSRV5580-3000	2250–3000	316 SS	Viton®	0.41
PRSRV5580-4000	3000–4000	316 SS	Viton®	0.41
PRSRV5580-5000	4000–5000	316 SS	Viton®	0.41
PRSRV5580-6000	5000–6000	316 SS	Viton®	0.41

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Compression type tube fittings are the most commonly used in gas handling systems. Suitable for high vacuum and high pressure applications, they require no special tools, soldering or welding for installation, and can be remade repeatedly. Used on thin or heavy walled tubing, these fittings are available in both brass or Type 316 Stainless Steel.

Where compression fitting size is indicated in Ordering Information, it designates the outside diameter of the tubing it will accept. For example, 1/8" compression will accept 1/8" OD tubing.

Part Numbers		Description/Tube Fitting
Brass	**Type 316 SS**	
Male Connector – For connecting female pipe threads to tubing		
PRSSG6705	PRSSG6715	1/16" NPT(M) x 1/8" compression
PRSSG6700	PRSSG6710	1/8" NPT(M) x 1/16" compression
PRSSG6701	PRSSG6711	1/8" NPT(M) x 1/8" compression
PRSSG6702	PRSSG6712	1/8" NPT(M) x 1/4" compression
PRSSG6703	PRSSG6713	1/4" NPT(M) x 1/8" compression
PRSSG6704	PRSSG6714	1/4" NPT(M) x 1/4" compression
Female Connector – For connecting male pipe threads to tubing		
PRSSG6721	PRSSG6731	1/8" NPT(F) x 1/8" compression
PRSSG6722	PRSSG6732	1/8" NPT(F) x 1/4" compression
PRSSG6723	PRSSG6733	1/4" NPT(F) x 1/8" compression
PRSSG6724	PRSSG6734	1/4" NPT(F) x 1/4" compression
Male Elbow – For connecting female pipe threads to tubing at right angles		
PRSSG6740	PRSSG6750	1/8" NPT(M) x 1/16" compression
PRSSG6741	PRSSG6751	1/8" NPT(M) x 1/8" compression
PRSSG6742	PRSSG6752	1/8" NPT(M) x 1/4" compression
PRSSG6743	PRSSG6753	1/4" NPT(M) x 1/8" compression
PRSSG6744	PRSSG6754	1/4" NPT(M) x 1/4" compression
Female Elbow – For connecting male pipe threads to tubing at right angles		
PRSSG6761	PRSSG6771	1/8" NPT(F) x 1/8" compression
PRSSG6762	PRSSG6772	1/8" NPT(F) x 1/4" compression
PRSSG6764	PRSSG6773	1/4" NPT(F) x 1/8" compression
PRSSG6765	PRSSG6774	1/4" NPT(F) x 1/4" compression

Part Numbers		Description/Tube Fitting
Brass	**Type 316 SS**	
Union – For joining tubing		
PRSSG6780	PRSSG6790	1/16" compression (both ends)
PRSSG6781	PRSSG6791	1/8" compression (both ends)
PRSSG6782	PRSSG6792	1/4" compression (both ends)
Reducing Union – For joining tubing of different sizes		
PRSSG6840	PRSSG6850	1/8" compression x 1/16" compression
PRSSG6841	PRSSG6851	1/4" compression x 1/8" compression
Bulkhead Union – For connecting tubing through a panel or bulkhead		
PRSSG6801	PRSSG6811	1/8" compression (both ends)
PRSSG6802	PRSSG6812	1/4" compression (both ends)
Union Tee – For joining tubing in "T" configurations		
PRSSG6820	PRSSG6830	1/8" compression (all ends)
PRSSG6821	PRSSG6831	1/4" compression (all ends)
Reducer – For reducing the size of a compression fitting		
PRS0202-3027	–	1/4" O.D. Tube x 1/8" compression
Tube End Male Adapter – For converting female pipe threads to tubing		
–	PRSSG6871	1/8" NPT(M) x 1/4" O.D. Tube
–	PRSSG6870	1/4" NPT(M) x 1/4" O.D. Tube
Compression Nut and Ferrule		
PRSSG6940	PRSSG6950	1/16" compression
PRSSG6941	PRSSG6951	1/8" compression
PRSSG6942	PRSSG6952	1/4" compression

Accessories

Pipe Fittings

Pipe fittings are typically used to join components together in a gas handling system – such as attaching a flowmeter to a regulator, or installing a relief valve. They are also used in systems which have been constructed using rigid pipe, as opposed to tubing.

The measurements specified in the Tables below conform to National Pipe Thread (NPT) designations, and may be either female (internal) type connections, or male (external) type connections – abbreviated as NPT(F) or NPT(M) accordingly. All pipe fittings shown have a maximum operating pressure of at least 3000 psig.

Part Number		Description/Pipe Fittings
Brass	**Type 316 SS**	
Male Elbow – For joining female pipe threads at a right angle		
PRS0202-5172	PRS0202-5173	1/4" NPT(M) x 1/4" NPT(M)
PRS0202-5104	–	3/8" NPT(M) x 3/8" NPT(M)
Female Elbow – For joining male pipe threads at a right angle		
PRS0202-5112	PRS0202-5114	1/8" NPT(F) x 1/8" NPT(F)
PRS0202-5113	PRS0202-5115	1/4" NPT(F) x 1/4" NPT(F)
Street Elbow – For joining female to male pipe threads at a right angle		
PRS0202-5095	PRS0202-5127	1/8" NPT(M) x 1/8" NPT(F)
PRS0202-5096	PRS0202-5122	1/4" NPT(M) x 1/4" NPT(F)
Female Tee – To make a 3-way connection of male pipe threads		
PRS0202-4987	PRS0202-4299	1/4" NPT(F) x 1/4" NPT(F) x 1/4" NPT(F)
Male Branch Tee – To make a 3-way connection of male by male by female pipe threads		
PRS0202-4984	PRS0202-5116	1/4" NPT(F) x 1/4" NPT(F) x 1/4" NPT(M)
Street Tee – To make a 3-way connection of male by female by male pipe threads		
PRS0202-5098	–	1/8" NPT(F) x 1/8" NPT(M) x 1/8" NPT(F)
PRS0202-5117	PRS0202-5118	1/4" NPT(F) x 1/4" NPT(M) x 1/4" NPT(F)
Pipe Cross – To make a 4-way connection of male pipe threads		
PRS0202-5188	PRS0202-5190	1/8" NPT(F)
PRS0202-5189	PRS0202-5099	1/4" NPT(F)

Part Number		Description/Pipe Fittings
Brass	**Type 316 SS**	
Male Hex Nipple – For joining female pipe threads		
PRS0202-5186	PRS0202-5187	1/8" NPT(M) x 1/8" NPT(M)
PRS0202-5092	PRS0202-5091	1/4" NPT(M) x 1/4" NPT(M)
Reducing Adapter – Used to reduce the size of male pipe thread		
PRS0202-5350	PRS0202-5351	1/4" NPT(F) x 1/8" NPT(M)
Male Hex Reducing Nipple – For joining female pipe threads of different dimensions		
PRS0202-5185	PRS0202-5108	1/4" NPT(M) x 1/8" NPT(M)
PRS0202-5094	–	1/2" NPT(M) x 1/4" NPT(M)
Male Hex Long Nipple – For joining female pipe threads at extended dimensions		
–	PRS0202-5184	1/8" NPT(M) x 1/8" NPT(M) (3" Length)
PRS202-5105	PRS0202-5107	1/4" NPT(M) x 1/4" NPT(M) (3" Length)
PRS0202-5106	–	1/4" NPT(M) x 1/8" NPT(M) (3-1/2" Length)
Female Hex Coupling – To join male pipe threads		
PRS0202-5182	PRS0202-5183	1/8" NPT(F) x 1/8" NPT(F)
PRS0202-5120	PRS0202-5121	1/4" NPT(F) x 1/4" NPT(F)
PRS0202-5103	–	3/8" NPT(F) x 1/4" NPT(F)
Reducing Bushing – Used to reduce the size of female pipe thread		
PRS0202-5181	PRS0202-5102	1/4" NPT(M) x 1/8" NPT(F)
PRS0202-5097	PRS0202-5133	1/2" NPT(M) x 1/4" NPT(F)
Pipe Plug (Hollow Hex) – To plug a female pipe thread		
PRS0202-3140	PRS0202-3147	1/8" NPT(M)
PRS0202-3143	PRS0202-3023	1/4" NPT(M)

Accessories

Cylinder Connections

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Cylinder connections are used for connecting various items of gas handling apparatus (such as pressure regulators or pigtails) directly to high pressure gas cylinders. The actual connection varies depending on the gas in the cylinder and is designated by a three digit code (CGA Connection Number) as set forth in Compressed Gas Association publication V-1. Cylinder connections consist of a CGA nut and CGA nipple and in some cases require a washer for sealing purposes.

Praxair offers cylinder connections in a variety of configurations and materials. One configuration, available in either brass or type 316 stainless steel, features a check valve housed within the CGA nipple. This configuration restricts flow to only one direction, and prevents "backflow" from the process to the cylinder.

Also offered are special type 316L stainless steel cylinder connections which end in a male vacuum-type face seal fitting for use in systems utilizing VCR® or VCR® compatible type fittings.

SSCGA580

Brass CGA580

SSCGA660

Specifications

- **Pressure Range**
  CGA 347, 680, 695 and 701: 3001–5500 psig
  CGA 677, 702 and 703: 5501–7500 psig
  CGA 290, 510, 678 and 679: 0–500 psig
  All Others: 0–3000 psig

Materials

Part Number	CGA Nipple	CGA Nut	Check Valve Seat
PRSSG6650-(CGA)	Brass	Brass	NA
PRSSG6650-(CGA)CV	Brass	Brass	EPDM
PRSSG6651-(CGA)	Type 316 Stainless Steel	Type 316 Stainless Steel	NA
PRSSG6651-(CGA)CV	Type 316 Stainless Steel	Type 316 Stainless Steel	Viton®
PRSSG6651-(CGA)VM	Type 316L Stainless Steel	Type 316 Stainless Steel	NA
PRSSG6652-(CGA)	Monel	Monel	NA

"(CGA)" shown above indicates that the various CGA connections, listed in the Ordering Information, are used to make up complete part numbers.

Ordering Information – Brass and Monel

	Brass		Brass with Check Valve		Monel		Teflon® Washers
CGA Number	Part Number	Outlet Connection	Part Number	Outlet Connection	Part Number	Outlet Connection	(Package of 25) Part Number
170	PRSSG6650-170*	1/8" NPT male	–	–	–	–	PRSSG3542
180	PRSSG6650-180	1/8" NPT male	–	–	–	–	PRSSG3541
320	PRSSG6650-320	1/4" NPT male	PRSSG6650-320CV	1/4" NPT male	PRSSG6652-320	1/4" NPT male	PRSSG6076
326	PRSSG6650-326	1/4" NPT male	PRSSG6650-326CV	1/4" NPT male	–	–	–
330	–	–	–	–	PRSSG6652-330	1/4" NPT male	PRSSG6076
346	PRSSG6650-346	1/4" NPT male	PRSSG6650-346CV	1/4" NPT male	–	–	–
350	PRSSG6650-350	1/4" NPT male	PRSSG6650-350CV	1/4" NPT male	–	–	–
500	PRSSG6650-500*	1/4" NPT male	–	–	–	–	–
510	PRSSG6650-510	1/4" NPT male	PRSSG6650-510CV	1/4" NPT male	–	–	–
540	PRSSG6650-540	1/4" NPT male	PRSSG6650-540CV	1/4" NPT male	–	–	–
580	PRSSG6650-580	1/4" NPT male	PRSSG6650-580CV	1/4" NPT male	–	–	–
590	PRSSG6650-590	1/4" NPT male	PRSSG6650-590CV	1/4" NPT male	–	–	–
660	PRSSG6650-660	1/4" NPT male	–	–	PRSSG6652-660	1/4" NPT male	PRSSG6075
670	–	–	–	–	PRSSG6652-670	1/4" NPT male	PRSSG6075

* Connection is chrome-plated brass.

Ordering Information – Cylinder Connections (Stainless Steel)

	Type 316 Stainless Steel		Type 316 SS with Check Valve		Type 316L Stainless Steel		Teflon Washers
CGA Number	Part Number	Outlet Connection	Part Number	Outlet Connection	Part Number	Outlet Connection	(Package of 25) Part Number
180	PRSSG6651-180	1/8" NPT male	–	–	–	–	PRSSG3541
320	PRSSG6651-320	1/4" NPT male	PRSSG6651-320CV	1/4" NPT male	PRSSG6651-320VM	1/4" male Vacuum*	PRSSG6076
326	PRSSG6651-326	1/4" NPT male	PRSSG6651-326CV	1/4" NPT male	PRSSG6651-326VM	1/4" male Vacuum*	–
330	PRSSG6651-330	1/4" NPT male	PRSSG6651-330CV	1/4" NPT male	PRSSG6651-330VM	1/4" male Vacuum*	PRSSG6076
346	PRSSG6651-346	1/4" NPT male	PRSSG6651-346CV	1/4" NPT male	PRSSG6651-346VM	1/4" male Vacuum*	–
350	PRSSG6651-350	1/4" NPT male	PRSSG6651-350CV	1/4" NPT male	PRSSG6651-350VM	1/4" male Vacuum*	–
510	PRSSG6651-510	1/4" NPT male	PRSSG6651-510CV	1/4" NPT male	PRSSG6651-510VM	1/4" male Vacuum*	–
540	PRSSG6651-540	1/4" NPT male	PRSSG6651-540CV	1/4" NPT male	PRSSG6651-540VM	1/4" male Vacuum*	–
580	PRSSG6651-580	1/4" NPT male	PRSSG6651-580CV	1/4" NPT male	PRSSG6651-580VM	1/4" male Vacuum*	–
590	PRSSG6651-590	1/4" NPT male	PRSSG6651-590CV	1/4" NPT male	PRSSG6651-590VM	1/4" male Vacuum*	–
660	PRSSG6651-660	1/4" NPT male	PRSSG6651-660CV	1/4" NPT male	PRSSG6651-660VM	1/4" male Vacuum*	PRSSG6075
670	PRSSG6651-670	1/4" NPT male	PRSSG6651-670CV	1/4" NPT male	PRSSG6651-670VM	1/4" male Vacuum*	PRSSG6075
677	PRSSG6651-677	1/4" NPT male	PRSSG6651-677CV	1/4" NPT male	–	–	–
678	PRSSG6651-678	1/4" NPT male	–	–	PRSSG6651-678VM	1/4" male Vacuum*	PRSSG6077
679	PRSSG6651-679	1/4" NPT male	–	–	PRSSG6651-679VM	1/4" male Vacuum*	PRSSG3543**
680	PRSSG6651-680	1/4" NPT male	–	–	–	–	–
695	PRSSG6651-695	1/4" NPT male	–	–	–	–	–
702	PRSSG6651-702	1/4" NPT male	–	–	–	–	–
703	PRSSG6651-703	1/4" NPT male	–	–	–	–	–
705	PRSSG6651-705	1/4" NPT male	–	–	–	–	PRSSG6078

* Connection is compatible with 1/4" VCR® fittings.
** Washers are constructed of lead and can also be used with CGA 110 connections.

Accessories

High Purity Flexible Hoses

High Pressure Flexible Hoses

316 SS high pressure flexible metal hoses are designed for strong, safe and flexible operation in demanding specialty gas environments. Zero permeation characteristics do not allow gas or atmosphere to pass through its wall in either pressure or vacuum applications. Ideal for flammable, toxic, high purity and small molecule gases.

- SS core, double SS braid. Style S - 3,850 psi
- SS core, double SS braid. Style H - 4,800 psi

Monel® Inner, Stainless Steel Braid

Monel high pressure flexible metal hoses with SS braid are ideal for oxygen service where particle impingement failure is a concern. The SS braid is more economical and allows higher working pressures than Monel braid.

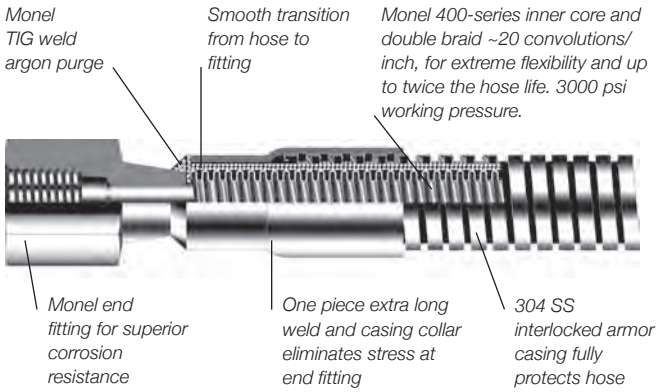
- Monel core, double SS braid. Style M – 4,200 psi
- Available with Monel or SS fittings.

Armor Casing

For hoses that are constantly handled and flexed, armor casing protects against kinking, braid abrasion or stress at the end fittings. The smooth surface also provides additional handling protection for operators, plus the capability to support a 600 lb load under tension. Armor casing is protected under a special 3 year limited warranty.

1/4" Style S (shown with SS Male NPT and Armor Casing)

1/4" Style M (shown with Monel Female NPT and SS Armor Casing)



Specifications

Hose Style	S	H	M
Size I.D. (in)	0.285	0.285	0.285
Size O.D. w/o Armor (in)	0.445	0.445	0.445
Size O.D. w/ Armor (in)	0.725	0.725	0.725
Inner Core Wall Thickness	0.010	0.010	0.010
MAWP (psig)	3,850	4,800	4,200
Minimum Burst Pressure (psig)	15,400	19,200	16,800
Minimum Bend Radius w/o Armor (in)	2.5	2.5	2.5
Minimum Bend Radius w/ Armor (in)	2.7	2.7	2.7
Weight Per Foot w/o Armor (lb)	0.29	0.29	0.33
Weight Per Foot w/ Armor (lb)	0.49	0.49	0.53
Temperature Range (°F)	Cryo to 1,500	Cryo to 1,500	Cryo to 1,500
Conductive (Yes/No)	Yes	Yes	Yes

Ordering Information

Stock Code	Description	Type	Working	Burst
PRSS33S000-24	1/4" X 24" SS Pigtail	Double Braid No Guard	3000	16,400
PRSS33S000-36	1/4" X 36" SS Pigtail	Double Braid No Guard	3000	16,400
PRSS33S000-72	1/4" X 72" SS Pigtail	Double Braid No Guard	3000	16,400
PRSS33MA00-36	1/4" X 36" Monel PT W/SS GRD	Double Braid Full Guard Monel	3000	16,400
PRSS33SA00-24	1/4" X 24" SS PT W/SS Guard	Double Braid Full Guard	3000	16,400
PRSS33SA00-36	1/4" X 36" SS PT W/SS Guard	Double Braid Full Guard	3000	16,400
PRSS33SA00-48	1/4" X 48" SS PT W/SS Guard	Double Braid Full Guard	3000	16,400
PRSS33SA00-72	1/4" X 72" SS PT W/SS Guard	Double Braid Full Guard	3000	16,400
PRSS33SA00HP-36	1/4" X 36" Pigtail W/SS CGA Check Valve	Double Braid Full Guard	5300	21,200
PRS5290029-CGA	1/4" X 36" Pigtail W/SS CGA Check Valve			
PRS5290031-CGA	1/4" X 36" Pigtail W/Brass CGA Check Valve			

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Series 8491 Flash Arrestor

The new 8491 Series re-settable flashback arrestors offer four (4) safety devices in each unit. Safety features include protection against flashbacks with a wide range of mixtures of oxygen or air with flammable gases including hydrogen, acetylene, methane, and LPG gases. The design includes a built-in non-return (check) valve to stop reverse flow and a thermal shut off which stops gas flow in the event a of hose or pipe line fire. An easily re-settable pressure control stops gas flow in the event of reverse flow or a flashback that creates 10 psig back pressure. This feature alerts the user that a reverse flow or a flashback of greater than 10 psig has occured. These units are easily reset by pulling up on the pressure control ring (shown at right), no disassembly of the gas line or special tools are needed. The 8491 Series high flow capacity makes them suitable for a broad range of applications (see flow table). Units are U/L listed.

Standard Features

- 100% flashback tested after assembly
- U/L listed and meets strict international standards:
  Working Pressures
  - Acetylene @ 15.0 psig
  - Hydrogen/oxygen @ 50.0 psig
  - Hydrogen/air @ 150.0 psig
  - LPG @ 50.0 psig
  - Oxygen @ 143.0 psig
- Automatically resets for flash backs and reverse flow below 10 psig
- Themal cut-off
- Stainless steel flame barrier positively extinguishes flame within housing
- Alerts user by shutting off gas flow in the event of a reverse flow or flashback exceeding 10 psig back pressure (captures back pressure in the housing, no flame or gas is exhausted to the atmosphere)
- Checks reverse flow and provides positive shut-off of reverse flow over 10 psig
- Built-in 100 micron stainless steel sintered filter on inlet
- High flow capacity (see table)

Materials of Construction

- **Body**
  Alloy 360 brass
- **Internals**
  Brass
- **Flame barrier**
  Stainless steel
- **Elastomers**
  Neoprene

Working Pressure (U/L)

Gas	Pressure psig
Acetylene	15.0
Hydrogen/oxygen	50.0
Hydrogen/air	150.0
Methane/LPG	50.0
Oxygen	143.0

Flow Performance

Inlet Pressure psig	Air Flow scfh
7.3	231.0
14.5	465.0
21.8	725.0
36.3	1041.0
72.5	1933.0

Ordering Information

		Connections	
Model	**Gas Service**	**Inlet**	**Outlet**
PRS8491-F	Flammable	1/4" NPT female	1/4" NPT female
PRS8491-O	Oxidizers	1/4" NPT female	1/4" NPT female
PRS8491-FL	Flammables	9/16-18 LH female	9/16-18 LH male
PRS8491-OR	Oxidizers	9/16-18 RH female	9/16-18 RH male

Accessories

Gas Heaters

Model SG6500 Carbon Dioxide and Nitrous Oxide Gas Heaters

The Model SG6500 gas heater is designed for use with either carbon dioxide or nitrous oxide to prevent regulator freeze-up under high flow conditions. Installed between the cylinder valve and a suitable regulator, the heater warms the gas stream allowing for flow rates up to 160 scfh without regulator freeze-up.

The gas heater is thermostatically controlled at 160 °F to prevent overheating of the gas. The heating element, encased in a polymeric body, efficiently radiates heat to the gas stream. The outer jacket of the heater provides insulation to allow the operator to install or remove the heater under warm conditions. The Model SG6500 Heater may be used in conjunction with any regulator that is suitable for carbon dioxide or nitrous oxide use.

SG6500 Heater

Specifications

- **Maximum Operating Pressure**
  3000 psig
- **Voltage**
  110 VAC
- **Power**
  120 watts, 1 amp
- **Maximum Flow Rate**
  160 scfh (CO_2)
- **Thermostat Setting**
  160 °F ±5 °F
- **Power Cord Length**
  5-1/2 feet
- **Dimensions (approximate)**
  6-1/2" x 2-1/2" x 1-3/4"
- **Approximate Weight**
  2 lb

Materials

- **Inlet and Outlet Connections**
  Brass
- **Other Metal Parts Exposed to Gas**
  Brass
- **Heater Block**
  Epoxy, Polymer

Ordering Information

Part Number	Gas Service	Inlet Connection	Outlet Connection
PRSSG6500-320	Carbon Dioxide	CGA 320	CGA 320 Adapter*
PRSSG6500-326	Nitrous Oxide	CGA 326	CGA 326 Adapter*

* Suitable for direct mounting of a pressure regulator with specified CGA.

Model SG7500 Electric High Flow Heaters for Compressed Gases

Model SG7500 electric heater is designed for use with nonflammable liquefied compressed gases to prevent regulator freeze-up and to assure uniform temperature under high flow conditions. Connected between the cylinder valve and a suitable regulator, the heater warms the gas stream allowing for flow rates up to 1000 scfh* (CO_2) without regulator freeze-up.

The heater is designed with a dry heat exchange medium made of aluminum and continuous high pressure stainless steel tubing with no internal joints.

SG7500 Heater

Standard Features

- Heavily insulated cabinet remains “cool”.
- Heater can be left on indefinitely, even under no-flow conditions, without resultant damage.
- Flow can be in either direction without loss of efficiency.
- Mounting bracket provides for convenient, wall mounted installation.
- C.S.A. approved

Optional Featues

- Manifold adapter block provides means to install heater between gas cylinder and regulator with CGA connections.

Specifications

- **Maximum Operating Pressure**
  3600 psig
- **Maximum Flow Rate**
  1000 scfh for CO_2 (at initial gas temperature 0 °F and 170 °F outlet)
  - Capacities for other gases will vary, depending of their specific heat.
- **Voltage:** 120 VAC
- **Power:** 1000 watts, 8.3 amps
- **Thermostat Setting:** 170 °F ±5 °F
- **Power Cord:** 6 ft., 3-wire UL/CSA listed
- **Inlet and Outlet Connections:** 1/4" MPT
- **Tubing:** 5/16" O.D. x .049 wall x 7 in long
- **Dimensions:**
  11" H x 5-1/2" W x 4-1/4" D
- **Mounting Holes:** 3 inch O/C
- **Approximate Weight:** 11 lb

Materials

- **Inlet and Outlet Connections**
  Type 316 Stainless Steel
- **Tubing**
  Type 304 Stainless Steel
- **Cabinet**
  Metal enclosure

Ordering Information

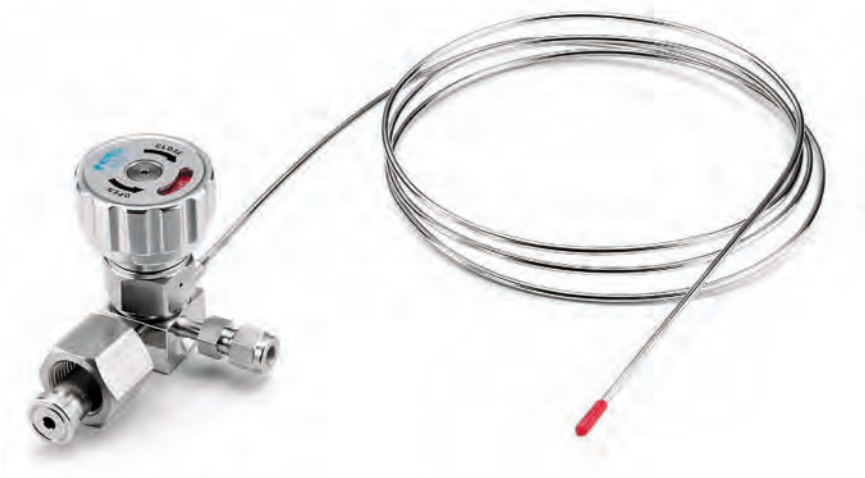
Part Number	Description
PRSSG7500	SG7500 Electric heater

Optional Equipment

Part Number	Manifold Block
PRS14-SS-320	CGA 320 x CGA 320 adapter
PRS14-SS-326	CGA 326 x CGA 326 adapter
PRS14-SS-580	CGA 580 x CGA 580 adapter

SFC/SFE – Start-Up Kit

The carbon dioxide SFC/SFE start-up kit developed by Praxair is designed to eliminate the chance of contaminating the carbon dioxide about to be used. The system was kept very simple to eliminate the chances for contamination. Special attention was given to the components that come in contact with carbon dioxide. Elastomers and polymers have been eliminated which could degrade or out gas deleterious components. To further ensure the system integrity, the kit is cleaned with super critical fluid carbon dioxide. This delivery system is designed for use in situations where the carbon dioxide cylinder is within eight (8) feet of the instrument. For applications in which the cylinder is further away, please consult your Praxair representative for custom delivery systems.



Ordering Information

Part Number	PRSCO2SFC-SFE01

MI9000 Moisture Indicator

The Model MI9000 indicator is used to indicate the downstream presence of moisture in a gas line from the exhaustion of the molecular sieve material in the Model 8000 and 8010 purifiers.

The indicator is constructed of brass and has a sealed glass window. The unit is furnished with indicating silica gel, which gradually changes color from blue (at relative humidities less than 4%) to pink/white (at relative humidities higher than 40%). At this point the silica gel has absorbed the maximum amount of water. The replaceable indicator plug is easily removed and replaced with the indicator body still in line.

Ordering Information

PRSMI9000	Moisture Indicator
PRSMI9000-100	Indicator Plug

Specifications

- **Max Operating Pressure**
  500 psi (3,450 kPA)
- **Connections**
  1/4" NPT Male x 1/4" Female
- **Overall Dimensions**
  3" L x 1-1/2" W x 2" D

550 Series Regulator Gauges

These 550 Series regulator gauges allow you to monitor pressure in systems. They are available in 2" diameter brass or 316L stainless for the 4000 Series regulators, and 2" chrome-plated brass with or without 316 stainless steel wetted parts for 3000 Series regulators. For the 2000 Series regulators 2-1/2" chrome-plated brass gauges are used.

For convenient mounting 550 Series are 1/4" NPT bottom mount, UL listed, and cleaned for oxygen service, ANSI B40.1.

2" Inch Gauges

2 1/2" Inch Gauges

Ordering Information – Series PRS550 Regulator Gauges, 4000 Series Regulators

2" Brass Pressure Range	2" Brass psig/kPa	2" Brass bar/psig	2" 316 SS Pressure Range	2" 316 SS psig/kPa	2" 316 SS bar/psig
30"-0-30 psig	PRS550-0201	PRS550-0300	30"-0-30 psig	PRS550-0221	PRS550-0320
30"-0-100 psig	PRS550-0202	PRS550-0302	30"-0-100 psig	PRS550-0222	PRS550-0322
30"-0-200 psig	PRS550-0203	PRS550-0303	30"-0-200 psig	PRS550-0223	PRS550-0323
0-300 psig	PRS550-0204	PRS550-0304	0-300 psig	PRS550-0224	PRS550-0324
0-400 psig	PRS550-0205	PRS550-0305	0-400 psig	PRS550-0225	PRS550-0325
0-1000 psig	PRS550-0206	PRS550-0306	0-1000 psig	PRS550-0226	PRS550-0326
0-4000 psig	PRS550-0208	PRS550-0308	0-4000 psig	PRS550-0228	PRS550-0328
0-6000 psig	PRS550-0209	PRS550-0309	0-6000 psig	PRS550-0229	PRS550-0329

Ordering Information – Series PRS550 Regulator Gauges, 3000 Series Regulators

2" Chrome-Plated Brass Pressure Range	2" Chrome-Plated Brass psig/kPa	2" Chrome-Plated Brass bar/psig	2" Chrome-Plated Brass, SS Internals Pressure Range	2" Chrome-Plated Brass, SS Internals psig/kPa	2" Chrome-Plated Brass, SS Internals bar/psig
30"-0-30 psig	PRS550-0267	PRS550-0367	30"-0-30 psig	PRS550-0621	PRS550-0720
30"-0-100 psig	PRS550-0268	PRS550-0368	30"-0-100 psig	PRS550-0622	PRS550-0722
30"-0-200 psig	PRS550-0269	PRS550-0369	30"-0-200 psig	PRS550-0623	PRS550-0723
0-300 psig	PRS550-0273	PRS550-0373	0-300 psig	PRS550-0624	PRS550-0724
0-400 psig	PRS550-0270	PRS841-0545	0-400 psig	PRS550-0625	PRS550-0725
0-1000 psig	PRS550-0271	PRS550-0371	0-1000 psig	PRS550-0626	PRS550-0726
0-4000 psig	PRS550-0263	PRS841-0546	0-4000 psig	PRS550-0628	PRS550-0728
0-6000 psig	PRS550-0272	PRS550-0372	0-6000 psig	PRS550-0629	PRS550-0729

Ordering Information – Series PRS550 Regulator Gauges, 2000 Series Regulators

2-1/2" Chrome-Plated Brass Pressure Range	2-1/2" Chrome-Plated Brass psig/kPa	2-1/2" Chrome Plated Brass bar/psig
0-30 psig	PRS550-0241	PRS550-0291
0-60 psig	PRS550-0242	PRS550-0292
0-200 psig	PRS550-0243	PRS550-0293
0-400 psig	PRS550-0245	PRS550-0295
0-600 psig	PRS550-0250	PRS550-0299
0-1000 psig	PRS550-0246	PRS841-0296
0-4000 psig	PRS550-0248	PRS550-0298
0-6000 psig	PRS550-0249	PRS550-0297
0-30 psig (Redline)	PRS550-0240	PRS550-0290

Accessories

Cylinder Scales

PRAXAIR
Making our planet more productive

Praxair's series of cylinder scales provides a means of measuring the weight of liquefied gases under pressure liquid in a cylinder. Accurate and reliable weight measurement of liquefied process gases enables the gas measurement system to maintain the high standards of product purity required by today's user.

Features and Benefits

- **Series PRS2310 and PRS 2350**
  4-20 Ma output
- **Allows for additional outputs**

Materials

- **Base**
  Corrosion resistant molded fiberglass with reinforced thermoplastic construction

Specifications

PRS2310

- **Indicator**
  3-1/2" Digital
- **Power**
  115v 85 vac
- **Platform**
  1-1/2"
- **Accuracy**
  0.5% full scale
- **Capacity**
  349 lb

PRS2330

- **Indicator**
  Mechanical
- **Power**
  N/A
- **Platform**
  1-1/2"
- **Accuracy**
  +/- 1% full scale
- **Capacity**
  300 lb

PRS2350

- **Indicator**
  3-1/2" Digital
- **Power**
  115v 85 vac
- **Platform**
  1-1/2"
- **Accuracy**
  0.5% full scale
- **Capacity**
  349 lb

Ordering Information

Digital Scales

Part Number	Description	Dimensions
PRS2308	Stainless Steel Gas Cabinet Scale	9" W x 9" D x 1-1/2" H
PRS2310	Single Cylinder	15-3/4" W x 15-3/4" D x 1-1/2" H
PRS2350	Two Cylinder	32" W x 18" D x 1-1/2" H
PRS4000SS-24	Dewar Scale	24" W x 24" D x 1-1/2" H
PRS4000SS-30	Dewar Scale	30" W x 30" D x 1-1/2" H

Mechanical Scales

Part Number	Description	Dimensions
PRS5305	Single Cylinder Hydraulic	
PRS2330	Two Cylinder	32" W x 18" D x 1-1/2" H

For a complete list of specifications please contact your Praxair representative.

Gas Detection Systems

Low Level Gas Detection

Gas Check G

GasCheck G rapidly and accurately detects almost any gas or gas mixture down to highly sensitive levels.

Designed for the search and location of gas leaks, GasCheck G has an advanced micro thermal conductivity sensor for fast, effective detection of almost any gas or gas mixture.

Robust and reliable, GasCheck G provides stable, repeatable readings of the detected gas. The instrument's LCD display, LED indicator and audible sounder clearly indicate the leak present.

GasCheck G automatically zeros to the ambient air around it when switched on and is ready to detect immediately. The instrument's easy to use graphical interface and intuitive keypad allows simple function, selection and adjustment.

Upgradeable throughout the range, GasCheck G is available in three distinct versions; G1, G2 and G3 with varied capabilities. Features can be easily added to upgrade the instrument without it having to be returned to the factory.

Features

- **Best available leak detection**
  - Fast, accurate leak detection at highly sensitive levels
  - Detects almost any known gas or gas mixture
  - Particularly sensitive to ammonia, argon, butane, helium, hydrogen and SF6
  - Reliable, stable, repeatable readings
- **Ease of use**
  - Simple, one handed operation
  - Large, clear LCD back lit display for easy viewing
  - Graphical icon menu
  - Conveniently calibrated against helium
- **Flexibility**
  - Choice of readings in cc/sec, g/yr, mg/m^3
  - Easily upgradeable throughout the range

GasCheck G Model Capabilities

	G1	G2	G3
Rapid detection of gas leaks	●	●	●
Measures gas leaks (single gas)		●	
Measures gas leaks (up to 20 gases)			●
Audible sounder	●	●	●
Flashing back-lit display	●	●	●
Peak hold readings		●	●
Factory or custom calibration available		●	●
Data logging (store up to 10 readings)			●
Readings displayed in cc/sec, g/yr, ppm or mg/m^3			●
Selectable battery type			●
Upgradeable	●	●	

Specifications

- **Detector**
  Micro thermal conductivity detector (MTCD) Sensor is poison resistant with over range protection
- **Operation**
  Battery Type: 4 x alkaline AA size or NiMH (rechargeable). Typically 40 hours life
- **Sensitivity (cc/sec)**
  He 1 x 10^{-5}, CH_4 5 x 10^{-5}, R12 5 x 10^{-5}, Ar 1 x 10^{-4}
- **Accuracy**
  – 5% Displayed reading – One digit
- **Response**
  T90 = 1 second rise and clear down
- **Sound**
  Flashing LED and 90 dBA (at 10 cm) audible sounder
- **Calibration**
  Factory calibrated to fully documented procedures in accordance with our ISO 9001:2008 Quality Management System
- **Data Logging**
  10 data points (available for G3 only.)
- **Temperature**
  Operating: -20 to +60 °C, -4 to 140 °F
  Storage: -20 to +70 °C, -4 to 158 °F
  Humidity: 0 to 99% RH (non-condensing)
- **Flow Rate**
  2 cc/min
- **Temperature**
  Operating: -20 to 60 °C, -4 to 140 °F
  Storage: -20 to 70 °C, -4 to 140 °F
  Humidity: 0-99% RH (non condensing)
- **Weight and Dimensions**
  Instrument with probe:
  390 x 60 x 49 mm, 15.5 x 2.3 x 1.9"
  Case:
  420 x 320 x 97 mm, 16.5 x 12.5 x 3.8"
  Instrument:
  0.45 kg, 1 lb, Packed 1.6 kg, 3.5 lb

Gas Detection Systems

Single Channel Wall Mount Controller

PRAXAIR
Making our planet more productive

The Beacon 110

The Beacon 110 is a powerful, low cost fixed system controller for one point of gas detection. It is microprocessor controlled, versatile, simple to install and operate, and priced to be the industry's best value single gas detection controller. It is capable of accepting RKI sensors directly for LEL level combustibles, Oxygen, CO_2, and toxic gas sensors. The Beacon 110 can also accept any 4-20 mA transmitter (2 or 3 wire, 24 VDC). Sensors can be mounted directly at the Beacon 110 housing, or can be wired remote from the controller.

Two 10 amp rated relay contacts allow direct control of external alarms and horns. The digital display has backlighting and simultaneous readout of the gas type and concentration.

The Beacon 110 is also housed in a NEMA 4X rated case for a weather tight seal. This case design complies with lock out/tag out standards and can be fully secured. An external reset switch allows the alarm to be silenced from outside of the controller housing. The Beacon 110 ships complete with a wall mounting kit for easy installation.

RKI offers the industry's widest selection of standard and toxic gas detection sensors, all of which can be utilized with the Beacon 110, providing gas monitoring protection for almost any application.

Features

- Low cost versatile solution
- Compact, weatherproof, NEMA 4X enclosure
- 115/220 VAC or 24 VDC operation
- Long life sensors (2+ years typical)
- Accepts RKI LEL/O_2/CO_2/toxic direct connect sensors
- Accepts any 4-20 mA transmitter
- Audible alarm with reset button
- Two programmable alarm levels
- Built-in trouble alarm with relay
- Relay rating 10 amps, form C
- Provides 4-20 mA output
- Optional Strobe

Applications

- Petrochemical plants
- Refineries
- Water and wastewater treatment plants
- Pulp and paper mills
- Gas, telephone, and electric utilities
- Parking garages
- Manufacturing facilities
- Steel
- Automotive
- HVAC

Specifications

Physical

- **Dimensions**
  Height: 8.5" (216 mm)
  Width: 7.0" (178 mm)
  Depth: 4.3" (109 mm)
- **Enclosure**
  Wall mounting grey fiberglass with hinged cover
- **Conduit Connection**
  3/4" NPT conduit hubs, 2 provided. 1 for sensor wiring and 1 for power & relay wiring
- **Wiring Termination**
  Screw type terminal block, 14 gauge max.
- **Power**
  Universal 115 VAC & 220 VAC, or 24 VDC nominal, battery backup option available
- **Controls**
  3 internal push buttons for setup, programming, and calibration. 1 external push button for alarm reset.

Operating Environment

- **Operating Temperature**
  -4 °F to 122 °F (-20 °C to 50 °C)
- **Storage Temperature**
  -4 °F to 158 °F (-20 °C to 70 °C)
- **Relative Humidity**
  0 - 95% RH (non-condensing)
- **Enclosure Rating**
  NEMA-4X enclosure, chemical, and weather resistant

Inputs

- **Direct Wired Sensors**
  LEL, Oxygen, Carbon Dioxide, and toxic gas sensors. Remote amp not required for less than 500 feet
- **4-20 mA Sensors**
  Accepts any 4-20 mA transmitter (24 VDC, 2 or 3 wire). A wide variety of RKI/Riken sensors are available with 4-20 mA signals. Wiring distances up to 8,000 feet

Inputs, *continued*

- **Sampling Methods**
  Diffusion and sample draw heads available

Outputs

- **Relays**
  Three relays – 10 amp rating (at 115 VAC), SPDT isolated contacts. 2 relays for gas alarms and 1 trouble relay. Relays fully programmable for: increasing or decreasing alarm, latching or self reset, normally energized or normally de-energized, time delay for alarm on and alarm off.
- **4-20 mA**
  Signal output, 4-20 mA (maximum load impedance 500 ohms), per channel
- **24 VDC**
  24 VDC (400 mA max) output provided to operate sample drawing adapters or other accessories

Outputs, *continued*

- **Display**
  2 x 8 Alphanumeric display with backlighting
- **Audible**
  Built-in audible alarm, 94 dB, mounted on enclosure. Coded output: pulsing = gas alarm, steady = fail
- **Visual**
  3 LED's on the front cover for alarm status indication, and malfunction. Optional top-mount strobe
- **Warranty**
  One year materials and workmanship

Gas Detection Systems

Two Channel Wall Mount Controller

The Beacon 200

The Beacon 200 is a powerful, low cost fixed system controller for two points of gas detection. It is microprocessor controlled, versatile, simple to install and operate, and priced to be the industry's most economical two point controller. It is capable of connecting directly to RKI sensors for LEL level combustibles, Oxygen, and toxic gas sensors. The Beacon 200 can also accept any 4-20 mA transmitter (2 or 3 wire, 24 VDC). Sensors can be mounted directly at the Beacon 200 housing, or can be wired remotely from the controller.

Two 10 amp rated relays per channel are strong enough to actuate most external alarms and horns without using slave relays. The digital display has backlighting and simultaneous readout of the gas type and concentration.

The Beacon 200's housing is rated NEMA 4X for corrosion resistance and a weather tight seal, and complies with lock out/tag out standards. An external reset switch allows the alarm to be silenced from outside of the controller housing. The Beacon 200 comes complete with a wall mounting kit for easy installation.

RKI offers the industry's widest selection of standard and toxic gas detection sensors, which can be utilized with the Beacon 200, providing gas monitoring protection for almost any application.

Features

- Simultaneous readout on 2 channels
- Two alarm levels per channel
- Discrete and common relays
- Built in audible alarm
- NEMA 4X enclosure
- 4-20 mA outputs
- Proven, long-life sensors for a wide variety of gases
- Accepts any 4-20 mA transmitter input (24 VDC)
- Easy to install, operate and expand
- CSA, C/US classified

Applications

- Petrochemical plants
- Refineries
- Water and wastewater treatment plants
- Pulp and paper mills
- Gas, telephone, and electric utilities
- Parking garages
- Manufacturing facilities
- Steel
- Automotive
- HVAC

Specifications

Physical

- **Dimensions**
  Height: 10.5" (267 mm)
  Width: 8.5" (216 mm)
  Depth: 6.3" (158 mm)
- **Enclosure**
  Wall mounting grey poly-carbonate with hinged cover
- **Conduit Connection**
  3/4" NPT conduit hubs, 3 provided. 2 for sensor wiring and 1 for power and relay wiring
- **Wiring Termination**
  Screw type terminal block, 14 gauge max
- **Power**
  115 VAC or 24 VDC standard, Optional 230 VAC. Battery backup option available
- **Controls**
  4 internal push buttons for setup, programming, and calibration. 1 external push button for alarm reset

Operating Environment

- **Operating Temperature**
  -4 °F to 122 °F (-10 °C to 50 °C)
- **Storage Temperature**
  -4 °F to 158 °F (-20 °C to 70 °C)
- **Relative Humidity**
  5 - 95% RH (non-condensing) 80% max for CSA
- **Enclosure Rating**
  NEMA-4X enclosure, waterproof, chemical, and weather resistant

Inputs

- **Direct Wired Sensors**
  LEL, Oxygen, and toxic gas sensors. Remote amp required for greater than 500 feet
- **4-20 mA Sensors**
  Accepts any 4-20 mA transmitter (24 VDC, 2 or 3 wire). A wide variety of RKI/Riken sensors are available with 4-20 mA signals; (See list of detectable gases.) Wiring distances up to 5,000 feet

Inputs, *continued*

- **Sampling Methods**
  Accepts diffusion or sample draw heads

Outputs

- **Relays**
  7 relays – 10 amp rating (at 115 VAC), SPDT isolated contacts. 2 relays for gas alarm levels per channel, plus 2 relays for common gas alarm and 1 common relay for malfunction. Relays fully programmable for: increasing or decreasing alarm, latching or self reset, normally energized or normally de-energized, time delay for alarm on and alarm off
- **4-20 mA**
  Signal output, 4-20 mA (into 1,000 ohms impedance maximum), per channel
- **24 VDC**
  24 VDC (350 mA max) output provided to operate sample drawing adapters

Outputs, *continued*

- **Display**
  Alphanumeric display with backlighting. 20 characters per line; 4 lines each
- **Audible**
  Built-in audible alarm, 94 dB, mounted on enclosure
  Coded output:
  pulsing = gas alarm,
  steady = fail
- **Visual**
  4 LED's on the front cover for alarm status indication, pilot, and malfunction

Approvals

- CSA Certified to CSA C22.2 No. 1010 and ANSI/ISA S82.01

Warranty

- One year material and workmanship

The Beacon 410

The Beacon 410 is a highly configurable, microprocessor-based, flexible and easy to use 4 channel gas monitor. It simultaneously displays the gas type, readings, and status for 4 channels of gas detection. It can monitor any combination of direct connect sensors (LEL combustibles, Oxygen, Oxygen, CO_2, and toxic gas sensors, and Carbon Dioxide) as well as any 4-20mA transmitters.

Each channel has 3 fully configurable alarm points. A built-in silenceable audible alarm alerts you to alarm conditions. Each channel also has 2 dedicated fully configurable relays and there is a bank of common relays as well. The common relays can optionally be configured as additional channel relays allowing up to 3 alarm relays per channel.

Each channel provides a 4-20mA output signal. A digital Modbus interface for remote logging of data via a Modbus network is standard. A Min-Max feature retains high and low peak readings for review at any time.

Field calibration is made simple by the easy to use Calibration Mode. A fully configurable high visibility strobe is available as an option. The unit can be powered from 115/220 VAC, an external 24 VDC source, or a 24 VDC backup battery. A trickle charging battery backup feature is also available as an option.

All features and functions of the Beacon 410 are controlled by easy to use menus on the backlit LCD display. The form-C (SPDT) relay contacts are rated at 10A, 250V, reducing or eliminating the need for additional slave relays. All features of the Beacon 410 are built into the unit so you never need to purchase or maintain any "add-on" cards or components.

Features

- Simultaneously monitor up to 4 channels
- Digital display of all 4 channels
- LEL/O_2/CO_2/toxic direct connect sensors
- Accepts any 4-20 mA transmitter, 2 or 3 wire
- 3 programmable alarm levels per channel
- Up to 3 configurable alarm relays per channel
- Zero follower automatically compensates sensor drift
- 4-20 mA analog and Modbus digital output standard
- 115/220 VAC or 24 VDC operation
- Audible alarm with silence feature
- Alarm reset switch
- Built in trouble alarm with relay
- Weather proof NEMA 4X enclosure
- Optional strobe and battery backup available

Applications

- Petrochemical plants
- Refineries
- Water and wastewater treatment plants
- Pulp and paper mills
- Gas, telephone, and electric utilities
- Parking garages
- Manufacturing facilities
- Steel
- Automotive
- HVAC

Specifications

Physical

- **Dimensions**
  Height: 12.5" (318 mm)
  Width: 11" (279 mm)
  Depth: 6.4" (136 mm)
- **Enclosure**
  NEMA 4X non-metallic for indoor and outdoor locations
- **Conduit Connection**
  3/4" NPT conduit hubs, 4 provided, for sensor, power, and relay wiring
- **Wiring Termination**
  Screw type terminal block, 14 gauge max
- **Power**
  115 VAC and 220 VAC, or 24 VDC nominal, battery backup option available
- **Controls**
  Display PCB Control Switches:
  - UP/YES push button switch
  - DOWN/NO push button switch
  - ESCAPE push button switch
  - ENTER push button switch
  - External reset switch
  - On/Off toggle switch

Environmental

- **Operating Temperature**
  -4 °F to 122 °F (-20 °C to 50 °C)
- **Storage Temperature**
  -4 °F to 158 °F (-20 °C to 70 °C)
- **Relative Humidity**
  0 - 95% RH (non-condensing)
- **Enclosure Rating**
  NEMA-4X enclosure, chemical and weather resistant

Inputs

- **Direct Wired Sensors**
  LEL, Oxygen, Carbon Dioxide, and toxic gas sensors. Remote amp not required for less than 500 feet

Inputs, *continued*

- **4-20 mA Sensors**
  Accepts any 4-20 mA transmitter (24 VDC, 2 or 3 wire). A wide variety of RKI/Riken sensors are available with 4-20 mA signals. Wiring distances up to 8,000 feet
- **Sampling Methods**
  Diffusion and sample draw heads available

Outputs

- **Relays**
  Two flexible, programmable Form-C (C, NO, NC) relays per channel, plus five common relays (Fail, Alarm-1, Alarm-2, Alarm-3, Alarm-Any). Common relays may optionally be assigned to function as additional channel alarm relays, providing for up to three alarm relays per channel. 10A contact rating.
- **4-20 mA**
  Signal output, 4-20 mA (maximum load impedance 500 ohms), per channel RS-485 Modbus format RS-485 serial output of all channel data, including gas reading and alarm status.
- **Display**
  4 x 20 backlit LCD display
- **Audible**
  Built-in audible alarm, 94 dB, mounted on enclosure. Coded output: pulsing = gas alarm, steady = fail
- **Visual**
  - Alarm LED's (on Display PCB)
    Alarm 1 - yellow, Alarm 2 - orange, Alarm 3 - red, Fail - yellow
  - Green Pilot LED to indicate AC power connected (on Display PCB)
  - An optional 24 VDC NEMA 4X strobe mounted to top of case.

Approvals

- CSA Certified to CSA C22.2 No. 1010 and ANSI/ISA S82.01

Gas Detection Systems

Two Channel Wall Mount Controller

The Beacon 800

The Beacon™ 800 is a versatile, low cost fixed system controller for one to eight points of gas detection. It is microprocessor controlled and is capable of accepting up to 8 separate 4-20 mA sensor transmitters which can be either 2 or 3 wire. The Beacon™ 800 can be powered by either 24 VDC, or 85-264 VAC. It is simple to operate and comes complete with a wall mount installation kit.

The 2 large digital displays have backlighting and easily identify both the gas type and the gas concentration for all 8 channels simultaneously. The Beacon™ 800 is housed in a NEMA 4X rated case for a weather tight seal. This case design complies with lock out / tag out standards and can be fully secured. An external reset switch allows alarms to be silenced from outside the controller housing. The bottom mounted wiring hubs allow for easy wiring.

With 3 amp rated relays, the Beacon™ 800 can be wired directly to a variety of devices like alarm horns, buzzers, or lights. This eliminates the need for costly external relays from the controller to devices. RKI offers the industry's widest selection of standard and toxic gas detection sensors, which can be utilized with the Beacon™ 800, providing gas monitoring protection for almost any application.

Features

- Capable of up to 8 separate channels
- Digital display of all 8 channels simultaneously
- Compact, weatherproof, NEMA 4X enclosure
- 85 to 264 VAC or 24 VDC operation
- Long life sensors (2+ years typical)
- Accepts any 4-20 mA transmitter
- Audible alarm with reset button
- Two programmable alarm levels per channel
- Common alarm and fail relays
- Relay rating 3 amps, form C
- Low cost versatile solution

Applications

- Petrochemical plants
- Refineries
- Water and wastewater treatment plants
- Pulp and paper mills
- Gas, telephone, and electric utilities
- Parking garages
- Manufacturing facilities
- Steel
- Automotive
- HVAC

Specifications

Physical

- **Dimensions**
  Height: 12.5" 318 mm
  Width 11.0" 279 mm
  Depth 6.4" 163 mm
- **Enclosure**
  Wall mounting grey fiberglass with hinged cover.
- **Conduit Connection**
  3/4" NPT conduit hubs, 4 provided for sensors, power, and relay wiring.
- **Wiring Termination**
  Screw type terminal block, 14 gauge max.

Operating Environment

- **Operating Temperature**
  -4 °F to 122 °F (-10 °C to 50 °C)
- **Storage Temperature**
  -4 °F to 158 °F (-20 °C to 70 °C)
- **Relative Humidity**
  0 - 100% RH
- **Enclosure Rating**
  NEMA-4X enclosure, waterproof, chemical, and weather resistant.

Inputs

- **4-20 mA**
  Accepts any 4-20 mA transmitter (24 VDC, 2 or 3 wire). A wide variety of RKI sensors are available with 4-20 mA signals. Wiring distances up to 8,000 feet.

Outputs

- **Relays**
  2 relays per channel 3 amp rating, SPDT isolated contacts.
  1 set of common relays:
  2 for gas alarm levels, 1 for malfunction
  Relays fully programmable for:
  Increasing or decreasing alarms, latching or self reset alarms, Normally energized or normally de-energized, time delay for alarm on and alarm off.
- **24VDC**
  24 VDC output provided to operate sample drawing adapters.
- **Display**
  2 alphanumeric displays with backlighting. 16 characters per line; 4 lines each. All 8 channels continuously displayed.
- **Audible**
  Built-in audible alarm, 94 dB, mounted on enclosure
  Coded output: pulsing = gas alarm, steady = fail
- **Visual**
  4 visual LED alarms on front cover for alarm indications, pilot, and malfunction.
- **Optional Expansion Cards**
  Individual 4-20 mA (or 1 - 5 VDC) outputs. Heavy duty relay card (4 each @ 30 amps)

Power

- 85-264VAC or 24VDC

Approvals

- CSA Certified to CSA C22.2 No. 1010 and ANSI/ISA S82.01

PRAXAIR
Making our planet more productive

The RKI Direct Connect series gas sensors are highly reliable and very cost effective for the detection of common gas hazards. The direct connect series are available for LEL, H_2 Specific LEL, LEL IR, Oxygen, H_2S, CO, CO_2, and for a variety of toxic gases. The sensors for LEL, H_2, Oxygen, H_2S, CO_2, and Carbon Monoxide are explosion-proof with flame arrestors, and approved for use in hazardous areas (Class 1, Div. 1 Groups B, C, D). An optional non-explosion proof version is available for oxygen, H_2S, CO, and CO_2 for use in non-hazardous atmospheres.

The Direct Connect sensors can be used in two different ways. The sensors can be mounted directly to the controllers as a complete stand alone system, or they can be mounted to explosion proof junction boxes for remote detection.

The toxic sensors are electrochemical type plug-in sensors, which provide high specificity, fast response, and long life. The plug-in design allows quick replacement in the field with no tools required. Toxic sensors are designed for use in Class I, Div. 2 hazardous locations. Sensors are available for NH_3, SO_2, PH_3, AsH_3, and HCN.

The Direct Connect sensors can be used either indoors or outdoors. The flame arrestors for the explosion-proof versions utilize a patented coating which make them water repellent. Also, splash guards are available for use in very wet environments. An optional stainless steel junction box is available for corrosive environments.

All of the Direct Connect sensors are designed to specifically interface with RKI Beacon 110, 200, and 410 controllers.

Features

- Available gases include – LEL, H_2S, CO, and CO_2
- Toxic sensors include – NH_3, AsH_3, HCN, PH_3, and SO_2
- Infrared sensor for combustibles and CO_2
- Patented water repellent sensor coating
- Explosion proof construction
- Optional stainless steel junction box

NH3 Sensor

Explosion Proof
O_2 / H_2S / CO

Explosion Proof
LEL

Explosion Proof
IR LEL and CO_2

Gas Detection Systems

Direct Connect Sensors

Direct Connect Sensors Specifications – Explosion Proof

	LEL General Purpose	LEL H_2 Specific	O_2 Oxygen	H_2S Hydrogen Sulfide	CO Carbon Monoxide	CH_4 Methane	HC Hydro-carbons	CO_2 Carbon Dioxide
Sensor								
Type	Catalytic	Catalytic	Galvanic cell	Electro-chemical	Electro-chemical	Infrared	Infrared	Infrared
Measuring Range	0-100% LEL	0-100% LEL	0-25% vol.	0-100 ppm	0-300 ppm	0-100% LEL	0-100% LEL	0 - 5000 ppm 0 - 5.0% volume 0 - 50% volume 0 - 100% volume
Lower Detectable Limit (LDL)	2% of full scale	2% of full scale	0.1% volume	2% of full scale	2% of full scale	2% of full scale	2% of full scale	2% of full scale
Response Time (T-90)	LEL – 30 Seconds	LEL H_2 – 20 Seconds	20 Seconds	35 Seconds	35 Seconds	30 Seconds	30 Seconds	30 Seconds
Accuracy	+/- 5% of full scale (0.5% volume for oxygen)							
Life Expectancy	2 to 3 years with normal service	3 to 5 years with normal service	2 to 3 years with normal service	2 to 3 years with normal service	2 to 3 years with normal service	5 years plus with normal service	5 years plus with normal service	5 years plus with normal service
Operating Environment								
Location	Indoor or outdoor. Explosion proof for Class I, Groups B, C, and D atmospheres.							
Temperature	-40 °F to 167 °F -40 °C to 75 °C	-40 °F to 167 °F -40 °C to 75 °C	-4 °F to 113 °F -20 °C to 45 °C	-40 °F to 104 °F -40 °C to 40 °C	23 °F to 104 °F -5 °C to 40 °C	-4 °F to 122 °F -20 °C to 50 °C	-4 °F to 122 °F -20 °C to 50 °C	-4 °F to 122 °F -20 °C to 50 °C
Humidity	0 - 99% RH non-condensing							
Housing								
Housing J-Box	Cast aluminum, explosion-proof, optional stainless steel J-box available							
Sensor	Stainless steel, explosion-proof							
Approvals	UL CSA	UL	CSA NRTL	CSA NRTL	CSA NRTL	C UL US	C UL US	C UL US
Controllers	Compatible with the following controllers: Beacon 110, Beacon 200, and Beacon 410							
Warranty	One year materials and workmanship							

Ordering Information – Sensor With J-Box

Description	Part Number
LEL General Purpose (UL)	PRS61-1000RK
LEL General Purpose (CSA)	PRS61-1000RK-05
LEL H_2 Specific	PRS61-1001RK
O_2 Oxygen	PRS65-2515RK
H_2S Hydrogen Sulfide	PRS65-2427RK-05
CO Carbon Monoxide	PRS65-2437RK-05
CH_4 Methane	PRS61-1003RK-CH4
HC Hydrocarbons	PRS61-1003RK-HC
CO_2 Carbon Dioxide (0 - 5000 ppm)	PRS61-1004RK-02
CO_2 Carbon Dioxide (0 - 5.0% volume)	PRS61-1004RK-03
CO_2 Carbon Dioxide (0 - 50% volume)	PRS61-1004RK-05
CO_2 Carbon Dioxide (0 - 100% volume)	PRS61-1004RK-10

Ordering Information – Sensor Only

Description	Part Number
LEL General Purpose (UL)	PRS61-0140RK
LEL General Purpose (CSA)	PRS61-0140RK-05
LEL H_2 Specific	PRSNC-6205-01
O_2 Oxygen	PRS65-2514RK
H_2S Hydrogen Sulfide	PRS65-2428
CO Carbon Monoxide	PRS65-2438
CH_4 Methane	PRS61-0190RK-CH4
HC Hydrocarbons	PRS61-0190RK-HC
CO_2 Carbon Dioxide (0 - 5000 ppm)	PRS61-0191RK-02
CO_2 Carbon Dioxide (0 - 5.0% volume)	PRS61-0191RK-03
CO_2 Carbon Dioxide (0 - 50% volume)	PRS61-0191RK-05
CO_2 Carbon Dioxide (0 - 100% volume)	PRS61-0191RK-10

Direct Connect Sensors Specifications – Non-Explosion Proof

	O_2 Oxygen	H_2S Hydrogen Sulfide	CO Carbon Monoxide	Toxics	CO_2 Carbon Dioxide
Sensors					
Type	Galvanic cell	Electrochemical	Electrochemical	Electrochemical	Infrared
Measuring Range	0 - 25% volume	0 - 100 ppm	0 - 300 ppm	See Chart Below	0 - 5000 ppm 0 - 5.0% volume 0 - 50% volume 0 - 100% volume
Lower Detectable Limit (LDL)	0.1% Vol.	2% of full scale	2% of full scale	2% of full scale	2% of full scale
Response Time (T-90)	20 seconds or less	35 seconds or less	35 seconds or less	60 seconds or less	30 seconds or less
Accuracy	0.5% volume	+/- 5% of full scale	+/- 5% of full scale	+/- 5% of full scale	+/- 5% of full scale
Life Expectancy	2 years with normal service	2 to 3 years with normal service	2 to 3 years with normal service	2 to 3 years with normal service	5 years plus with normal service
Operating Environment					
Location	Indoor or outdoor, Class I, Div. 2	Indoor or outdoor, Class I, Div. 2	Indoor or outdoor, Class I, Div. 2	Indoor or outdoor, Class I, Div. 2	Indoor or outdoor, Class I, Div. 2
Temperature	-4° F to 122 °F -20 °C to 50 °C	-4° F to 122 °F -20 °C to 50 °C	-4° F to 122 °F -20 °C to 50 °C	14 °F to 104 °F -10 °C to 40 °C	-4 °F to 122 °F -20 °C to 50 °C
Humidity	0 - 99% RH non-condensing	0 - 99% RH non-condensing	0 - 99% RH non-condensing	0 - 99% RH non-condensing	0 - 99% RH non-condensing
Housing					
Housing J-Box	Cast aluminum, explosion-proof	Cast aluminum,	Cast aluminum,	Cast aluminum,	Cast aluminum,
Sensor	Stainless steel, explosion-proof	Stainless steel, explosion-proof	Stainless steel, explosion-proof	Stainless steel, explosion-proof	Stainless steel, explosion-proof
Controllers	Compatible with the following controllers: Beacon 110, Beacon 200, and Beacon 410				
Warranty	One year materials and workmanship	One year materials and workmanship	One year materials and workmanship	One year materials and workmanship	One year materials and workmanship

Ordering Information – Sensor With J-Box

Description	Part Number
O_2 Oxygen	PRS65-2497RK
O_2 Oxygen	PRS65-2502RK*
H_2S Hydrogen Sulfide	PRS65-2498RK
CO Carbon Monoxide	PRS65-2499RK
CO_2 Carbon Dioxide (0 - 5000 ppm)	PRS61-1007RK-02
CO_2 Carbon Dioxide (0 - 5.0% volume)	PRS61-1007RK-03
CO_2 Carbon Dioxide (0 - 50% volume)	PRS61-1007RK-05
CO_2 Carbon Dioxide (0 - 100% volume)	PRS61-1007RK-10

* Partial pressure sensor for helium (He) applications. Consult your Praxair representative for details.

Ordering Information – Sensor Only

Description	Part Number
O_2 Oxygen	PRS65-2494RK
O_2 Oxygen	PRS65-2510RK*
H_2S Hydrogen Sulfide	PRS65-2495RK
CO Carbon Monoxide	PRS65-2496RK
CO_2 Carbon Dioxide (0 - 5000 ppm)	PRS61-0198RK-02
CO_2 Carbon Dioxide (0 - 5.0% volume)	PRS61-0198RK-03
CO_2 Carbon Dioxide (0 - 50% volume)	PRS61-0198RK-05
CO_2 Carbon Dioxide (0 - 100% volume)	PRS61-0198RK-10

* Partial pressure sensor for helium (He) applications. Consult your Praxair representative for details.

Ordering Information – Toxic Sensor Transmitter (optional junction box)

Part Number With J-Box	Part Number Without J-Box	Gas	Range
65-2301RK-AsH3	65-2300RK-AsH3	Arsine (AsH_3)	0 - 1.5 ppm
65-2301RK-NH3	65-2300RK-NH3	Ammonia (NH_3)	0 - 75.0 ppm
65-2301RK-HCN	65-2300RK-HCN	Hydrogen Cyanide (HCN)	0 - 15 ppm
65-2301RK-PH3	65-2300RK-PH3	Phosphine (PH_3)	0 - 1.00 ppm
65-2301RK-SO2	65-2300RK-SO2	Sulfur Dioxide (SO_2)	0 - 6.00 ppm

Gas Detection Systems

Intelligent Gas Detector

GD-70D Series

The new Model GD-70D smart gas detection transmitter series sets a new standard for performance, flexibility, and versatility. The GD-70D sample-draw transmitter offers an array of sensor technologies unmatched in the industry, including unique offerings, such as our hydrogen-specific or LEL versions.

The long life high capacity pump and wide variety of sensing elements are replaceable in a few seconds, with no tools required. The smart sensors retain all calibration and sensor-specific data in non-volatile memory, so sensors can be hot-swapped in the field with no programming required. The sensors also retain calibration information, which means they can be conveniently calibrated separate from the transmitter, avoiding transport of calibration gases to field locations. The GD-70D firmware automatically corrects for long-term zero and span "drift" minimizing maintenance and maximizing reliability.

The GD-70D can be used as a stand-alone device, offering a number of communication protocols to existing PLC systems, or can be integrated with the Beacon series of single and multi-channel controllers.

All GD-70D transmitters include a large, easy to read integral LCD display, tri-color bar graph for visual notification of alarm status, programmable low and high alarm relays, and fault relay. Pump flow is self-tuning for maintenance-free operation. Because all GD-70D base units are identical, sensors can be interchanged with no programming or tools required, resulting in maximum flexibility to the user.

Features

- Monitor combustibles, O_2, and a wide range of toxics
- Plug and play intelligent sensors retain calibration and sensor data
- Common platform (main unit/sensor/pump) for all detection methods
- Universal main unit (all sensor types)
- Multifunctional sensor unit (new intelligent sensor)
- No internal tubing (main unit)/no coil (pump)
- Front access, no tools required, easy sensor and pump replacement
- Large size LCD screen
- Various communication methods available (4-20mA, LonWorks, and PoE)
- Minimal maintenance cost through enhanced troubleshooting firmware functions
- Small mounting space
- Environmentally friendly
- Wide variety of sensors available

S2 Model

The S2 series gas sensor/transmitters are highly reliable and very cost effective for the detection of common gas hazards. The S2 series are available for LEL, H_2 Specific (LEL, and ppm), Oxygen, H_2S, CO, and for a variety of toxic gases. The transmitters for LEL, H_2 Specific, Oxygen, H_2S, CO_2, and Carbon Monoxide are explosion-proof with flame arrestors, and approved for use in hazardous areas (Class I, Groups B, C, D). An optional non-explosion proof version is available for oxygen, H_2S, CO, and CO_2 in non-hazardous atmospheres. LEL sensors are available using catalytic bead and infrared technologies.

The toxic sensors are electrochemical type plug-in sensors, which provide high specificity, fast response, and long life.

The plug-in design allows quick replacement in the field with no tools required. Toxic sensors are designed for use in Class I, Div. 2 hazardous locations. Sensors available for NH_3, SO_2, PH_3, AsH_3, and HCN.

The S2 transmitters can be used either indoors or outdoors. The flame arrestors for the explosion-proof versions utilize a patented coating which make them water repellent. Splash guards are also available for use in very wet environments. An optional stainless steel junction box is available for corrosive environments.

All of the S2 transmitters are designed to interface with Beacon controllers, or with PLC/DCS systems.

Features

- Available gases include – LEL, H_2S, CO, PPM H_2, and CO_2
- Toxic gases include – NH_3, SO_2, HCN, and more
- Infrared sensor for combustibles and CO_2
- Hydrogen-specific now available
- Patented water repellent sensor coating
- 4-20 mA output
- Explosion proof construction
- Optional stainless steel junction box

Explosion Proof
O_2 / CO / H_2S

Explosion Proof
LEL

NH3 Sensor

Gas Detection Systems

Gas Sensor/Transmitter

S2 Model Specifications – Explosion Proof

	LEL General Purpose	LEL H_2 Specific	H_2 PPM Hydrogen	O_2 Oxygen	H_2S Hydrogen Sulfide	CO Carbon Monoxide	CO_2 Carbon Dioxide	CH_4 Methane	HC Hydro-carbons
Sensors									
Type	Catalytic	Catalytic	Metal oxide semi-conductor	Galvanic cell	Electro-chemical	Electro-chemical	Infrared	Infrared	Infrared
Measuring Range	0-100% LEL	0-100% LEL (H_2 Specific)	0-1000 ppm 0-2000 ppm	0-25% vol.	0-100 ppm	0-300 ppm	0-5000 ppm 0-5% vol. 0-50% vol. 0-100% vol.	0-100% LEL	0-100% LEL
Lower Detectable Limit (LDL)	2% of full scale	2% of full scale	2% of full scale	0.1% vol.	2% of full scale	2% of full scale	2% of full scale	2% of full scale	2% of full scale
Max Current Draw (24VDC)	200 mA (power wires) 25 mA (signal wires) 3 wires			20 mA max, 2 wires	20 mA max, 2 wires	20 mA max, 2 wires	60 mA (power wires) 25 mA (signal wires) 3 wires		
Response Time (T-90)	30 Seconds	20 Seconds	45 Seconds	20 Seconds	45 Seconds	30 Seconds	30 Seconds	30 Seconds	30 Seconds
Accuracy (whichever is greater)	± 5% of reading or ± 2% LEL	± 5% of reading or ± 2% LEL	± 10% of reading or ± 5% of full scale	± 0.5% O_2	± 5% of reading ± 2 ppm H_2S	± 5% of reading ± 5 ppm CO	± 5% of reading or ± 2% of full scale	± 5% of reading or ± 2% of full scale	± 5% of reading or ± 2% of full scale
Life Expectancy	2 to 3 years with normal exposure to flammable gas	3 to 5 years with normal service	5 years plus with normal service	2 to 3 years with normal service	2 to 3 years with normal service	2 to 3 years with normal service	5 years plus with normal service	5 years plus with normal service	5 years plus with normal service
Operating Environment									
Location	Indoor or outdoor. Explosion proof for Class I, Div. 1, Groups B, C, and D.								
Temperature	-40 °F to 167 °F -40 °C to 75 °C	-40 °F to 167 °F -40 °C to 75 °C	-40 °F to 167 °F -40 °C to 75 °C	-4 °F to 113 °F -20 °C to 45 °C	-40 °F to 104 °F -40 °C to 40 °C	23 °F to 104 °F -5 °C to 40 °C	-4 °F to 122 °F -20 °C to 50 °C	-4 °F to 122 °F -20 °C to 50 °C	-4 °F to 122 °F -20 °C to 50 °C
Humidity	0 - 99% RH, non condensing								
Housing									
Housing J Box	Cast aluminum explosion proof, optional stainless steel J-box available								
Sensor	Stainless steel explosion proof								
Controls									
Zero	Sets transmitter output to 4 mA with zero output from sensor								
Span	Sets transmitter output to proper level when span gas is applied								
Output	4 - 20 mA signal								
Operating Voltage	11 VDC to 30 VDC	11 VDC to 30 VDC	19 VDC to 30 VDC	19-30VDC (250 OHMS impedance max)			11 VDC to 30 VDC	11 VDC to 30 VDC	11 VDC to 30 VDC
Approvals	UL C CSA US	UL C CSA US	UL	CSA NRTL	CSA NRTL	CSA NRTL	C UL US	C UL US	C UL US
Controllers	Compatible with the following controllers: Beacon 110, Beacon 200, Beacon 410, and 800, also PLC and DCS systems								
Warranty	One year materials and workmanship								

Ordering Information

Description	Part Number
LEL General Purpose (UL approved)	PRS65-2405RK
LEL General Purpose (C CSA US approved)	PRS65-2405RK-05
LEL H_2 Specific (UL approved)	PRS65-2451RK
LEL H_2 Specific (C CSA US approved)	PRS65-2451RK-05
H_2 PPM Hydrogen (0-1000 ppm)	PRS65-2442RK-1000
H_2 PPM Hydrogen (0-2000 ppm)	PRS65-2442RK-2000
O_2 Oxygen	PRS65-2322RK
H_2S Hydrogen Sulfide	PRS65-2331RK

Description	Part Number
CO Carbon Monoxide	PRS65-2336RK
CO_2 Carbon Dioxide (0 - 5000 ppm)	PRS65-2396RK-02
CO_2 Carbon Dioxide (0 - 5.0% volume)	PRS65-2396RK-03
CO_2 Carbon Dioxide (0 - 50% volume)	PRS65-2396RK-05
CO_2 Carbon Dioxide (0 - 100% volume)	PRS65-2396RK-10
CH_4 Methane	PRS65-2394RK-CH4
HC Hydrocarbons	PRS65-2394RK-HC

S2 Model Specifications – Non-Explosion Proof

	O_2 Oxygen	H_2S Hydrogen Sulfide	CO Carbon Monoxide	Toxics	CO_2 Carbon Dioxide
Sensor					
Type	Galvanic cell	Electrochemical	Electrochemical	Electrochemical	Infrared
Measuring Range	0-25% volume	0 - 100 ppm	0 - 300 ppm	See chart below	0 - 5000 ppm 0 - 5% volume 0 - 50% volume 0 - 100% volume
Lower Detectable Limit (LDL)	0.1% volume	2% of full scale	2% of full scale	2% of full scale	2% of full scale
Accuracy (whichever is greater)	± 0.5% O_2	± 5% of reading ± 2 ppm H_2S	± 5% of reading ± 5 ppm CO	± 10% of reading or ± 5% of full scale	± 5% of reading or ± 2% of full scale
Life Expectancy	2 years with normal service	2 to 3 years with normal service	2 to 3 years with normal service	2 to 3 years with normal service	5 years plus with normal service
Response Time (T-90)	20 Seconds	45 Seconds	30 Seconds	60 Seconds	30 Seconds
Operating Environment					
Location Indoor	Class I, Div. 2	Class I, Div. 2	Class I, Div. 2	Class I, Div. 2	Class I, Div. 2
Temperature	-4 °F to 122 °F -20 °C to 50 °C	-4 °F to 122 °F -20 °C to 50 °C	-4 °F to 122 °F -20 °C to 50 °C	14 °F to 104 °F -10 °C to 40 °C	-4 °F to 122 °F -20 °C to 50 °C
Humidity	0-99% RH non-condensing	0-99% RH non-condensing	0-99% RH non-condensing	5-95% RH	0-99% RH non-condensing
Housing					
Housing J-Box	Cast aluminum, explosion-proof	Cast aluminum, explosion-proof	Cast aluminum, explosion-proof	Cast aluminum, explosion-proof	Cast aluminum, explosion-proof
Sensor	Plastic or aluminum	Plastic or aluminum	Plastic or aluminum	Plastic or aluminum	Plastic or aluminum
Controls					
Zero	Sets transmitter output to 4 mA with zero output from sensor				
Span	Sets transmitter output to 20 mA with full scale output from sensor				
Operating Voltage	19 VDC to 30 VDC	19 VDC to 30 VDC	19 VDC to 30 VDC	19 VDC to 30 VDC	19 VDC to 30 VDC
Output	4-20 mA signal	4-20 mA signal	4-20 mA signal	4-20 mA signal	4-20 mA signal
Controllers	Compatible with the following controllers: Beacon 110, Beacon 200, Beacon 410, and 800, also PLC and DCS systems				
Warranty	One year materials and workmanship				

Ordering Information

Description	Part Number
O_2 Oxygen	PRS65-2321RK
H_2S Hydrogen Sulfide	PRS65-2330RK
CO Carbon Monoxide	PRS65-2335RK
CO_2 Carbon Dioxide (0 - 5000 ppm)	PRS65-2397RK-02
CO_2 Carbon Dioxide (0 - 5.0% volume)	PRS65-2397RK-03
CO_2 Carbon Dioxide (0 - 50% volume)	PRS65-2397RK-05
CO_2 Carbon Dioxide (0 - 100% volume)	PRS65-2397RK-10

Ordering Information – Non-Explosion Proof Toxic Assemblies

Part Number	Gas	Range
PRS65-2340RK-ASH3	Arsine (AsH_3)	0 - 1.5 ppm
PRS65-2340RK-NH3	Ammonia (NH_3)	0 - 75 ppm
PRS65-2340RK-HCN	Hydrogen Cyanide (HCN)	0 - 15 ppm
PRS65-2340RK-PH3	Phosphine (PH_3)	0 - 1.00 ppm
PRS65-2340RK-SO2	Sulfur Dioxide (SO_2)	0 - 6.00 ppm

Gas Detection Systems

One to Six Gas Portable Monitor

Eagle Model

The Eagle one to six gas portable monitor provides the most versatile portable gas detector on the market. Equipped with features that are not available on most competitive units, the Eagle is a powerful instrument that does more than just offer the standard confined space protection for LEL, O_2, H_2S and CO. Detection combinations never before offered in a portable gas monitor are now available featuring the industry's widest selection of high quality, long life and field proven sensors.

Unique Eagle features include PPM or LEL hydrocarbon detection at the push of a button; infrared sensors for CO_2, methane or hydrocarbons in LEL and % volume ranges; a methane elimination switch for environmental applications, a long list of super toxic gases and measurable ranges, and dual hydrophobic filters that increases its water resistant performance. The Eagle has a strong internal pump with a low flow auto shut off and alarm, which can draw samples from up to 125 feet even with the dual hydrophobic filters in place. This allows for quick response and recovery from distant sampling locations. The Eagle will continuously operate for over 30 hours on alkaline batteries or 18 hours on Ni-Cads. A variety of accessories are also available to help satisfy almost any application such as long sample hoses, special float probes for tank testing, datalogging, continuous operation adapters, remote alarms and strobes, and dilution fittings, just to name a few.

With its ergonomic design and large glove friendly buttons, the Eagle offers easy access to controls such as autocalibration, alarm silence, demand zero, peak hold and a wide variety of other features. Each channel has two alarm levels plus TWA and STEL alarms for toxic channels. The two alarm levels are user adjustable and can be latching or self resetting. Rugged, reliable, easy to operate and maintain, the Eagle is the solution for just about any portable gas monitoring situation.

Features

- Simultaneous detection of up to 6 different gases
- Over 400 gas monitoring configurations
- Wide range of toxic gases
- PPM/LEL hydrocarbon detection
- Powerful long-life pump up to 125' range with filters
- Low flow pump shut off and alarm
- Methane elimination switch for environmental use
- Security "Adjustment Lockout Switch"
- Up to 30 hours of continuous operation
- Alkaline or Ni-Cad capability
- IR Sensors available for CO_2, % LEL CH_4 or HC, % volume CH_4 or HC
- Transformer testing version available
- Datalogging option
- Autocalibration/single gas calibration
- Dual hydrophobic filters (most versions)
- Ergonomic RFI/EMI/chemical/weather resistant enclosure
- Intrinsically safe design, CSA (C/US) and UL classified (most versions)
- Complies with EPA Method 21

See specifications for the Eagle on the following page.

Gas Detection Systems

One to Six Gas Portable Monitor

PRAXAIR
Making our planet more productive

Specifications

- **Enclosure**
  Weatherproof, chemical resistant, RFI/EMI coated high impact polycarbonate-polyester blend. Can operate in rain or set into 2.0" of water without damage. Ergonomically balanced with rugged top mounted handle
- **Dimensions**
  10.5" L x 5.9" W x 7" H
- **Weight**
  5 lbs (standard 4 gas with batteries)
- **Detection Principle**
  Catalytic combustion, electrochemical cell, galvanic cell, infrared
- **Sensor Life**
  2 years under normal conditions
- **Sampling Method**
  Powerful, long-life pump (over 6,000 hours) can draw samples over 125 feet. Flow rate approximately 2.0 SCFH
- **Display**
  4 x 20 LCD readout. Viewed through window in case top. Displays readings and status of 4 channels simultaneously. Backlight, automatic for alarms and by demand with adjustable time
- **Alarms**
  2 alarms per channel plus TWA and STEL alarms for toxics. The two alarms are fully adjustable for levels, latching or self reset and silenceable
- **Alarm Method**
  Buzzer 85 dB at 30 cm, dual high intensity LED's, and flashing display
- **Controls**
  6 External glove friendly push buttons for operation, demand zero, and auto-calibration. Buttons also access LEL/ppm, alarm silence, peak hold, TWA/STEL values battery status and many other features
- **Continuous Operation**
  30 hours minimum using alkaline batteries, or 18 hours using Ni-Cad
- **Power Source**
  4 Alkaline or Ni-Cad, size D batteries (Charger has alkaline recognition to prevent battery damage if charging is attempted with alkalines)
- **Operating Temperature and Humidity**
  -10 °C to 40 °C (14 °F to 104 °F), 0 to 95% RH, non-condensing
- **Response Time**
  30 Seconds to 90% (most gases) using standard 5 ft hose
- **Safety Rating**
  Intrinsically Safe, Class I, Division 1, Groups A, B, C, D. CSA (C / US) and UL classified (most versions)
- **Standard Accessories**
  Shoulder strap, alkaline batteries, hydrophobic probe and 5 foot hose, internal hydrophobic filter (most versions) (certain toxic versions equipped with special probe, inlet fitting and 3' teflon hose. For HF and O3 versions, 3' PTFE hose used without probe)
- **Optional Accessories**
  - Datalogging of up to 4 gases (No data logging possible on 5 or 6 gas versions or versions with more than 2 toxic sensors)
  - Remote alarms
  - Dilution fitting (50/50)
  - Ni-Cad batteries
  - Battery charger, 115 VAC, 220 VAC, or 12 VDC
  - Continuous operation adapter, 115 VAC or 12 VDC
  - Extra loud buzzer
  - Extension probes
  - Large internal hydrophobic filter
- **Warranty**
  Two year material and workmanship

Gases and Detectable Ranges

Gas	Measuring Range	Accuracy
Standard Confined Space Gases		
Hydrocarbons (CH_4, standard)	0 - 100% LEL	± 5% of reading or ± 2% LEL*
	0 - 50,000 ppm	± 25 ppm or ± 5% of reading*
Oxygen (O_2)	0 - 40% volume	± 0.5% O_2
Carbon Monoxide (CO)	0 - 500 ppm	± 5% of reading or ± 5 ppm CO*
Hydrogen Sulfide (H_2S)	0 - 100 ppm	± 5% of reading or ± 2 ppm H_2S *
Super Toxics and Other Gases		
Ammonia (NH_3)	0 - 75 ppm	± 10% of reading or ± 5% of full scale*
Arsine (AsH_3)	0 - 1 ppm 0 - 200 ppb	± 10% of reading or ± 5% of full scale*
Chlorine (Cl_2)	0 - 3 ppm	± 10% of reading or ± 5% of full scale*
Chlorine Dioxide (ClO_2)	0 - 1 ppm	± 10% of reading or ± 5% of full scale*
Fluorine (F_2)	0 - 5 ppm	± 10% of reading or ± 5% of full scale*
Hydrogen Fluoride (HF)	0 - 9 ppm	± 10% of reading or ± 5% of full scale*
Hydrogen Chloride (HCl)	0 - 15 ppm	± 10% of reading or ± 5% of full scale*
Hydrogen Cyanide (HCN)	0 - 30 ppm	± 10% of reading or ± 5% of full scale*

* Whichever is greater

Gas	Measuring Range	Accuracy
Super Toxics and Other Gases, *continued*		
Hydrogen Selenide (H_2Se)	0 - 0.2 ppm	± 10% of reading or ± 5% of full scale*
Hydrogen Sulfide (H_2S)	0 - 1 ppm 0 - 30 ppm	± 10% of reading or ± 5% of full scale*
Nitrogen Dioxide (NO_2)	0 - 15 ppm	± 10% of reading or ± 5% of full scale*
Ozone (O_3)	0 - 1 ppm	± 10% of reading or ± 5% of full scale*
Nitric Oxide (NO)	0 - 100 ppm	± 10% of reading or ± 5% of full scale*
Phosphine (PH_3)	0 - 1 ppm	± 10% of reading or ± 5% of full scale*
Silane (SiH_4)	0 - 15 ppm	± 10% of reading or ± 5% of full scale*
Sulfur Dioxide (SO_2)	0 - 6 ppm	± 10% of reading or ± 5% of full scale*
IR Sensors		
Carbon Dioxide (CO_2) (IR Sensor)	0 - 5,000 ppm 0 - 10,000 ppm 0 - 5% volume 0 - 20% volume 0 - 60% volume	± 5% of reading or ± 2% of full scale*
Methane (CH_4) (IR Sensor)	0 - 100% LEL 0 - 100% volume	± 5% of reading or ± 2% of full scale*
Isobutane (iC_4H_{10}) (IR Sensor)	0 - 100% LEL 0 - 30% volume	± 5% of reading or ± 2% of full scale*

* Whichever is greater

Gas Detection Systems

One to Six Gas Portable Monitor with PID Capability

Eagle 2 Model

Eagle 2 is the next generation of our popular Eagle portable gas detector. Equipped with features that are not available on competitive units, the Eagle 2 is a powerful instrument that does more than just offer the standard confined space protection for LEL, O_2, H_2S and CO.

The Eagle 2 available features include a PID sensor for detecting high or low ppm levels (0-50 and 0-2,000) of VOC gases; % volume capability for CH_4 and H_2 using a TC (thermal conductivity) sensor; PPM or LEL hydrocarbon detection at the push of a button; infrared sensors for CO_2 (ppm or % volume), methane or hydrocarbons in LEL and % volume ranges; methane elimination feature for environmental applications; and a variety of super toxic gases. The Eagle 2 has a strong internal pump with a low flow auto pump shut off and alarm, which can draw samples from up to 125 feet. This allows for quick response and recovery from distant sampling locations. The Eagle 2 will continuously operate for over 18 hours on alkaline batteries or 20 hours on NiMH. A variety of accessories are also available to help satisfy almost any application such as long sample hoses, special float probes for tank testing, and dilution fittings, just to name a few. Datalogging is a standard feature for all sensors on all versions.

With its ergonomic design and large glove friendly buttons, the Eagle 2 offers easy access to controls such as autocalibration, alarm silence, demand zero, peak hold, methane elimination, and a wide variety of other features. Each channel has two alarm levels plus TWA and STEL alarms for toxic channels. The two alarm levels are user adjustable and can be latching or self resetting. Rugged, reliable, easy to operate and maintain, the Eagle 2 is the solution for just about any portable gas monitoring situation. Also, the display can be set to any of 5 languages: English, French, German, Italian, or Spanish.

See specifications for the Eagle 2 on the following page.

Features

- Monitor up to 6 different gases
- PPM, % LEL, or % volume auto-ranging combustible detection
- Specialty Sensors
  - PID (Photoionization Detector)
    - Low or high range for VOC detection
    - Fence Electrode Technology for humidity and contamination resistance
  - Infrared (IR)
    CO_2, % LEL CH_4, % volume CH_4, % LEL HC, % volume HC
  - Thermal Conductivity (TC)
    % volume H_2, % volume CH_4
  - Smart toxic, plug and play sensors
    NH_3, AsH_3, Cl_2, HCN, PH_3, and SO_2
- Multilingual (5 languages)
- Powerful long-life pump up to 125' range
- Low flow pump shut off and alarm
- Methane elimination for environmental use
- Alkaline 18 hours or NiMH 20 hours capability
- Password protection
- Datalogging standard
- Autocalibration/single gas calibration
- Internal hydrophobic dust filter
- External probe with hydrophobic filter
- Ergonomic RFI/EMI/chemical/weather resistant enclosure
- Intrinsically safe design, CSA approval

Gas Detection Systems

One to Six Gas Portable Monitor

PRAXAIR
Making our planet more productive

Specifications

- **Enclosure**
  Weatherproof, chemical resistant, RFI/EMI coated high impact polycarbonate-PBT blend. Can operate in 2" of water without leakage. Ergonomically balanced with rugged top mounted handle. Water and dust resistant equivalent to IP64
- **Dimensions**
  9.5" L x 5.25" W x 5.875" H
- **Weight**
  3.8 lbs (standard 4 gas with batteries)
- **Detection Principle**
  Catalytic combustion, electrochemical cell, galvanic cell, infrared, photoionization detector, and thermal conductivity
- **Sampling Method**
  Powerful, long-life internal pump (over 6,000 hours) can draw samples over 125 feet. Flow rate approximately 2.0 SCFH
- **Display**
  3 display modes: display all gases, large font-autoscroll, or large font-manual scroll. Polyurethane protected overlay. Backlight, illuminates for alarms and by demand, with adjustable time
- **Language**
  Readout can display in 5 languages (English, French, German, Italian, or Spanish)
- **Alarms**
  2 Alarms per channel plus TWA and STEL alarms for toxics. The two alarms are fully adjustable for levels, latching or self reset, and silenceable
- **Alarm Method**
  Buzzer 95 dB at 30 cm, four high intensity LED's
- **Controls**
  4 External glove friendly push buttons for operation, demand zero, and auto-calibration. Buttons also access LEL/ppm, alarm silence, peak hold, TWA/STEL values, battery status, conversion factors, and many other features
- **Continuous Operation**
  At 70 °F, 18 hours using alkaline batteries, or 20 hours using NiMH
- **Power Source**
  4 alkaline or NiMH, size C batteries (Charger has alkaline recognition to prevent battery damage if charging is attempted with alkalines)
- **Operating Temperature and Humidity**
  -20 °C to 50 °C (-4 °F to 122 °F), 0 to 95% RH, non-condensing
- **Environmental**
  IP-64
- **Response Time**
  30 Seconds to 90% (for most gases) using standard 5 ft hose
- **Safety Rating**
  Intrinsically Safe, Class I, Groups A, B, C, D. Approvals: CSA / CE
- **Standard Accessories**
  Shoulder strap, alkaline batteries, hydrophobic probe, and 5 foot hose, internal hydrophobic filter
- **Optional Accessories**
  - Dilution fitting (50/50)
  - NiMH batteries
  - Battery charger, 115 VAC, 220 VAC, or 12 VDC (charge time 4 hours)
  - Continuous operation adapter, 115 VAC or 12 VDC
  - Extension hoses
- **Warranty**
  Two year material and workmanship, one year for PID sensor.

Gases and Detectable Ranges

Gas	Measuring Range	Accuracy
Standard Confined Space Gases		
Hydrocarbons (CH_4, standard)	0 - 100% LEL	± 5% of reading or ± 2% LEL*
	0 - 5% volume (CH_4)	± 5% of reading or ± 2% LEL*
	0 - 50,000 ppm	± 25 ppm or ± 5% of reading*
Oxygen (O_2)	0 - 40% volume	± 0.5% O_2
Carbon Monoxide (CO)	0 - 500 ppm	± 5% of reading or ± 5 ppm CO*
Hydrogen Sulfide (H_2S)	0 - 100 ppm	± 5% of reading or ± 2 ppm H_2S*
Toxics		
Ammonia (NH_3)	0 - 75 ppm	± 10% of reading or ± 5% of full scale*
Arsine (AsH_3)	0 - 1.5 ppm	± 10% of reading or ± 5% of full scale*
Chlorine (Cl_2)	0 - 3 ppm	± 10% of reading or ± 5% of full scale*
Hydrogen Cyanide (HCN)	0 - 15 ppm	± 10% of reading or ± 5% of full scale*
Phosphine (PH_3)	0 - 1 ppm	± 10% of reading or ± 5% of full scale*
Sulfur Dioxide (SO_2)	0 - 6 ppm	± 10% of reading or ± 5% of full scale*

* Whichever is greater

Gas	Measuring Range	Accuracy
IR Sensors		
Carbon Dioxide (CO_2)	0 - 10,000 ppm 0 - 5% volume 0 - 60% volume	± 5% of reading or ± 2% of full scale*
Methane (CH_4)	0 - 100% LEL/ 0 - 100% volume	± 5% of reading or ± 2% of full scale*
Hydrocarbons	0 - 100% LEL/ 0 - 30% volume	± 5% of reading or ± 2% of full scale*
PID Sensors		
VOC	0 - 2,000 ppm 0 - 50 ppm	– –
TC Sensors		
Methane (CH_4)	0 - 100% volume	± 5% of reading or ± 2% of full scale*
Hydrogen (H_2)	0 - 10% volume 0 - 100% volume	± 5% of reading or ± 2% of full scale*

* Whichever is greater

The EAGLE 2 can be configured with up to 6 gas sensors from this list.

Safety Apparatus

Cylinder Handling

Two cylinder process station rack, PRS277

Three cylinder process station rack, PRS377

Four cylinder process station, PRS400P

Six cylinder process station, PRS600P

Six lecture bottle carrier, PRS760

Three lecture bottle holder, wall or bench mount, PRS730

Single lecture bottle holder, benchtop, PRS700

Two wheel one cylinder hand truck, PRS901

Four wheel one cylinder hand truck, PRS903

Four wheel one cylinder pneumatic tires hand truck, PRS904

Ordering Information

Part Number	Description	Dimension L x W x H	Weight (lb)
Process Cylinder Stations			
PRS277	Two cylinder process station rack	12" x 28" x 72"	66
PRS377	Three cylinder process station rack	12" x 40" x 72"	84
PRS477	Four cylinder in-line process station	14" x 52" x 72"	97
PRS400P	Four cylinder process station	24" x 40" x 72"	98
PRS600P	Six cylinder process station	24" x 52" x 72"	129
Small Cylinder Stands			
PRS700	Lecture bottle size benchtop bottle holder, PVC	5" x 8" x 8"	1.5
PRS710	Lecture bottle size single bottle bolder, wall/bench mount	8" x 5" x 4"	1.5
PRS730	Lecture bottle size triple bottle holder, wall/bench mount	7.5" x 11" x 4"	4
PRS760	Lecture bottle size six bottle carrier, PVC	9" x 6" x 19"	6
Single Cylinder Gas Hand Trucks			
PRS901	Two wheel cylinder hand truck, 12.375" maximum dia.	18" x 18" x 47"	35
PRS902	Heavy duty two wheeled hand truck, one cylinder	18" x 19" x 47"	37
PRS902 SS	Stainless steel/poly wheel single cylinder with hand truck	18" x 18" x 47"	34
PRS903	Four wheel one cylinder hand truck semi-pneumatic tires	19" x 19" x 47"	44
PRS904	Four wheel hand truck, pneumatic tires, one cylinder	19" x 21" x 47"	48
PRS905	Two wheel hand truck semi-pneumatic with locking post	18" x 18" x 47"	41
PRS906	Heavy duty two wheel hand truck with locking post, one cylinder	19" x 19" x 47"	44
PRS907	Four wheel one cylinder hand truck, semi-pneumatic tires with locking post	18" x 18" x 47"	51
PRS908	Four wheel hand truck, pneumatic tires with locking post, one cylinder	19" x 19" x 47"	54

Single cylinder wall bracket, PRS100 SS

Chain set all brackets, PRS105

Double cylinder wall bracket, PRS200

Single cylinder adjustable bracket, PRS110

Double cylinder bench mount bracket, PRS250

Triple cylinder wall bracket, PRS300

Ordering Information – Gas Cylinder Handling Equipment

Part Number	Description	Dimension L x W x H	Weight (lb)
PRS100	Single cylinder wall bracket	4.25" x 8" x 2.25"	3
PRS100 SS	Single cylinder wall bracket, stainless steel	4.25" x 8" x 2.25"	3
PRS100A	Replacement 54" black strap assembly	54" Long	1
PRS105	Optional chain set, all brackets	41" Long	1
PRS110	Single cylinder adjustable bracket	4" x 9" x 2"	2
PRS150	Single cylinder bench mount bracket	4.25" x 8" x 4.25"	3
PRS150SS	Single cylinder bench mount bracket, stainless steel	4.25" x 8" x 4.25"	3
PRS181	Single cylinder floor stand	16" x 16" x 15"	21
PRS200	Double cylinder wall bracket	4.25" x 24" x 2.25"	8
PRS200 SS	Double cylinder wall bracket, stainless steel	4.25" x 24" x 2.25"	9
PRS250	Double cylinder bench bracket	4.25" x 24" x 4.25"	11
PRS250SS	Two cylinder bench mount bracket, stainless steel	4.25" x 24" x 4.25"	11
PRS275	Two cylinder wall /floor stand	12" x 28" x 30"	41
PRS275 SS	Two cylinder wall /floor stand, stainless steel	12" x 28" x 30"	44
PRS300	Triple cylinder wall bracket	4.25" x 36" x 2.25"	11
PRS375	Three cylinder wall/floor stand	12" x 40" x 30"	49
PRS400	Four cylinder floor stand	24" x 40" x 30"	69
PRS400W	Single cylinder wall bracket	8.25" x 2" x 4.5"	2
PRS401	Four cylinder wall bracket	4.25" x 48" x 2.25"	14
PRS420W	Single cylinder bench mount	5.5" x 3.5" x 5"	2
PRS430	Four cylinder wheel cart	24" x 40" x 31"	153
PRS475	Four cylinder in-line racks	14" x 52" x 30"	63
PRS600	Six cylinder floor stand rack	24" x 52" x 30"	84
PRS630	Six cylinder wheeled cart	24" x 52" x 30"	183
PRS800	Eight cylinder floor stand rack	24" x 64.5" x 30"	96
PRS2501	Snap Cap™ cylinder safety cap, high pressure, fine thread	6.5" x 3.125"	4
PRS2502	Snap Cap™ cylinder safety cap, low pressure, fine thread	6.5" x 3.5"	4
PRS2503	Snap Cap™ cylinder safety cap, high pressure, coarse thread	6.5" x 3.125"	4
PRS2504	Snap Cap™ cylinder safety cap low pressure coarse thread	6.5" x 3.5"	4
PRS430CS	4 inch caster set with hardware for 4 cylinder cart, G-430 and G-630		14

Single cylinder wall bracket, PRS400W

Three cylinder wall/floor stand, PRS375

Safety Apparatus

Cylinder Handling

Single cylinder floor stand, PRS181

One cylinder tube rack, PRS1x1

Four cylinder tube rack, 2 wide x 2 deep, shown with process rail, PRS2x2

Eight cylinder tube rack, 4 wide x 2 deep, PRS4x2

Four cylinder wheeled cart, PRS430

Four cylinder floor stand, PRS400

Ordering Information – Cylinder Barricade Racks, Structural Tube Design

Part Number	Description (Cylinder Stations Wide x Deep)	Size W x D x H	Weight (lb)
PRS-1X1	1 Cylinder tube rack (1 cylinder wide x 1 deep)	16" x 16" x 30"	58
PRS-1x2	2 Cylinder tube style rack (1 cylinder wide x 2 deep)	16" x 26" x 30"	82
PRS-1x3	3 Cylinder tube rack 1 (cylinder wide x 3 deep)	16" x 38" X 30"	92
PRS-1x4	4 Cylinder tube style rack (1 cylinder wide x 4 deep)	16" x 50" x 30"	110
Process Rail	Add controls mounting rail to any 1 cylinder wide rack	16" W x 72" H	+30
PRS-2x1	2 Cylinder tube rack (2 cylinder wide x 1 deep)	30" x 16" x 30"	91
PRS-2x2	4 Cylinder tube style rack (2 cylinder wide x 2 deep)	30" x 26" x 30"	120
PRS-2x3	6 Cylinder tube rack (2 cylinder wide x 3 deep)	30" x 38" x 30"	154
PRS-2X4	8 Cylinder rack (2 cylinder wide x 4 deep)	30" x 50" x 30"	190
Process Rail	Add controls mounting rail to any 2 cylinder wide rack	30" W x 72" H	+35
PRS-3x1	3 Cylinder tube rack (3 cylinder wide x 1 deep)	44" x 16" x 30"	124
PRS-3x2	6 Cylinder tube rack (3 cylinder wide x 2 deep)	44" x 26" x 30"	165
PRS-3x3	9 Cylinder rack (3 cylinder wide x 3 deep)	44" x 40" x 30"	211
PRS-3x4	12 Cylinder rack (3 cylinder wide x 4 deep)	44" x 50" x 30"	308
Process Rail	Add controls mounting rail to any 3 cylinder wide rack	44" W x 72" H	+40
PRS-4x1	4 Cylinder rack (4 cylinder wide x 1 deep)	58" x 16" x 30"	194
PRS-4x2	8 Cylinder rack (4 cylinder wide x 2 deep)	58" x 26" x 30"	249
PRS-4x3	12 Cylinder rack (4 cylinder wide x 3 deep)	58" x 40" x 30"	294
PRS-4x4	16 Cylinder rack (4 cylinder wide x 4 deep)	58" x 50" x 30"	339
Process Rail	Add controls mounting rail to any 4 cylinder wide rack	58" W x 72" H	+45
PRS-FN	Fire resistant wall panel, one hour rated, Marinite I™ Fire Block in steel shell	28" x 1.75" x 75"	160
PRS-FW	Fire resistant wall panel, one hour rated, Marinite I™ Fire Block in steel shell	52" x 1.75" x 75"	190
PRS-CRYO1	Cryogenic cylinder rack for 1 cylinder up to 22 inch diameter	28" x 26" x 40"	107
PRS-CRYOL	Cryogenic cylinder rack for 1 cylinder up to 33 inch diameter	38" x 36" x 40"	117
PRS-CRYO2	Cryogenic cylinder rack for 2 cylinders up to 22 inch diameter	54" x 26" x 40"	155
PRS-CRYOL2	Cryogenic cylinder rack for 2 cylinders up to 33 inch diameter	74" x 36" x 40"	170

Personal Protective Equipment

Disposable Foam Ear Plugs, Ear Muffs and First Aid Kits

PRAXAIR
Making our planet more productive

Stay safe with the help of personal protective equipment from Praxair.

We strive to work with our customers to share our commitment to safety through the products and services we offer.

Because Praxair has a strong safety culture, we are continually modifying and expanding our product offerings to meet local and national safety standards and regulations. We are committed to assisting customers improve their own safety performance and compliance.

We have a broad range of safety products including eye and face, hands, hearing and respiratory protection, as well as protective clothing and other occupational safety products. The large selection of quality products come from leading manufacturers such as Aearo, 3M Products, North Safety Products, Kimberly Clark, DuPont, *ProStar*® Products, Jackson, Honeywell, Draeger, Moldex and many others. You will find the best products for all your applications.

Praxair's *ProStar* product offering is our private brand of products made by top name manufacturers, carefully selected for quality, reliability, comfort and value. Here is a sample of a few of these products. Contact your local Praxair representative at 1-877-PRAXAIR or 1-877-772-9247 to discuss your safety product needs.

ProStar® Hearing Protection

Hearing protection is essential for workers in high noise environments. The NRR, or Noise Reduction Rating, of a hearing protection device is the amount of decibels by which it will reduce noise exposure.

ProStar First Aid Kits

Ideal for home, office, work sites and vehicles. Each state or province has different requirements for First Aid kits. There are several options to suit the number of employees and the type of box – ie plastic, metal or soft sided.

We can help you make the right selections based on your specific work environment.

ProStar® Disposable Foam Ear Plugs

Features

- ***ProStar* Foam Ear Plugs**
  - Superior fit and excellent protection
  - Soft, comfortable, easy-to-use, self-adjusting
  - Won't interfere with day-to-day job routine
  - NRR 32dB
- ***ProStar* Original Ear Muffs**
  - 3-position headband
  - Adjustable, soft foam-filled ear cups
  - NRR 25dB
- ***ProStar* Basic Ear Muffs**
  - Ergonomic, lightweight – less that 8 oz.
  - 3-position headband, can be worn over head, under chin or behind head
  - Ear cups contoured individually for optimal fit
  - NRR 21dB
- ***ProStar* Impulse Active Ear Muffs**
  - Amplifies low level sound by up to 16db
  - Limits speaker output to a safe 85db
  - Dual microphones, volume control and speakers for natural hearing
  - Requires 2 - AA batteries
  - NRR 22dB
- ***ProStar* First Aid Kits**
  - Kits contain a variety of bandages and dressings, sterile cotton, tape, antiseptic wipes, first aid cream, cold pack, nitrile gloves, first aid fact sheet and more.
  - Please ask your Praxair representative about the requirements and options available in your state or province

ProStar Original Ear Muffs, PRS67005

ProStar Basic Ear Muffs, PRS67001

ProStar Impulse Active Ear Muffs, PRS67000

Ordering Information

Part Number	Description
PRS67002	*ProStar* Disposable Foam Ear Plugs – 6 pairs
PRS67003	*ProStar* Disposable Foam Ear Plugs –100 pairs, poly-bagged in pairs
PRS67004	*ProStar* Disposable Foam Ear Plugs – 200 pairs, poly-bagged in pairs
PRS67005	*ProStar* Original Ear Muffs
PRS67001	*ProStar* Basic Ear Muffs
PRS67000	*ProStar* Impulse Active Ear Muffs
PRS6C000	*ProStar* First Aid Kit – 10-person kit, plastic case
PRS6C001	*ProStar* First Aid Kit – 25-person kit, plastic case

ProStar First Aid Kits, PRS6C001

Eye and Face Protection

Face Shields, Safety Glasses and Goggles

Providing Workers with Protection Without Sacrificing Comfort and Style

Choosing the correct eye protection requires identification of the hazards in the environment, such as, impact injury, dust irritation, chemical splash, etc.; consideration of additional factors like sharp temperature changes, lens options, and meeting the applicable ANSI requirements. Polycarbonate lenses are the most effective for impact protection.

Standard Lens Tints

- **Clear Lens** – Allows maximum visible light transmission, this safety lens is used for indoor applications where impact protection is required.
- **Smoke Lens –** Worn on bright, sunny days, this lens provides maximum glare reduction and is ideal when eye strain is a major factor.
- **Amber/Yellow Lens –** Light gathering properties make this lens ideal for low-light environments where contrast is low.

Specialty Lens Tints

- **IRUV 3.0 Lens –** Protects against infrared (IRUV) and ultraviolet radiation. Perfect for light cutting and brazing applications.
- **IRUV 5.0 Lens –** Protects against infrared (IRUV) and ultraviolet radiation. Perfect for medium to heavy cutting and brazing applications.
- **Smoke Mirror Lens –** Smoke tint sunglass with outer mirror finish coating, for outdoor use where sunlight can cause eyestrain and fatigue.
- **Blue Mirror –** Smoke tint sunglass with outer blue mirror finish coating, for outdoor use where sunlight can cause eyestrain.

ProStar® Face Shields

ProStar Clear Goggles

ProStar Vista Safety Glasses, PRS66200

ProStar Aeon Safety Glasses, PRS66206

ProStar Vortex Safety Glasses, PRS66209

Features

- ***ProStar®* Face Shield Visor and Headgear Combinations**
  Stronger, more durable and more heat resistant than ordinary face shields. Windows are .060` thick for extra protection
- ***ProStar* Clear Goggles**
  Protection from flying debris and dust. Soft rolled edge offers close fit and comfort. Indirect ventilation allows wide angle vision and protection from liquid and chemical splash entering the eyes. Choice of vented or perforated.
- **ProStar Vista Safety Glasses**
  Economical protection, integrated side shields
- ***ProStar* Aeon Safety Glasses**
  Cutting edge style, adjustable nosepiece, flexible temples – gunmetal grey plastic frames
- ***ProStar* Vortex Safety Glasses** Sleek, sporty style, **comfortable** temples, lightweight construction with wrap-around lens protection.

Ordering Information

Part Number	Description
PRS65000	3" crown with a clear standard wide face shield
PRS65001	4" crown with a clear wide vision face shield
PRS65002	4" crown with a shade 5 wide vision face shield
PRS66005	*ProStar* clear goggles – 6 vents
PRS66007	*ProStar* clear goggles – perforated
PRS66200	*ProStar* Vista safety glasses – clear lens and frame
PRS66201	*ProStar* Vista safety glasses – smoke lens and frame
PRS66202	*ProStar* Vista safety glasses – amber lens and frame

Part Number	Description
PRS66203	*ProStar* Aeon safety glasses – clear lens
PRS66204	*ProStar* Aeon safety glasses – mirror lens
PRS66205	*ProStar* Aeon safety glasses – blue mirror lens
PRS66206	*ProStar* Aeon safety glasses – smoke lens
PRS66207	*ProStar* Vortex safety glasses – clear lens
PRS66208	*ProStar* Vortex safety glasses – smoke lens
PRS66209	*ProStar* Vortex safety glasses – blue mirror lens
PRS66210	*ProStar* Vortex safety glasses – amber lens
PRS66211	*ProStar* Vortex safety glasses – shade 3 lens
PRS66212	*ProStar* Vortex safety glasses – shade 5 lens

ProStar® Lens Cleaning Towelettes

- Individual pre-moistened towelettes clean face shields, helmets, safety glasses and goggles. Low lint tissues with anti-fog and anti-static formula.
- Ideal for industrial, office or lab environments.
- 200 towelettes per box

ProStar Lens Cleaning Station

- With this disposable station you can bring lens cleaning wherever it is needed. It can be positioned close to workers and is easily moved.
- Clean frequently to prolong the life of eyewear.
- Contains 16 oz. anti-fog, anti-static lens cleaner fluid with pump and 1200 tissues.

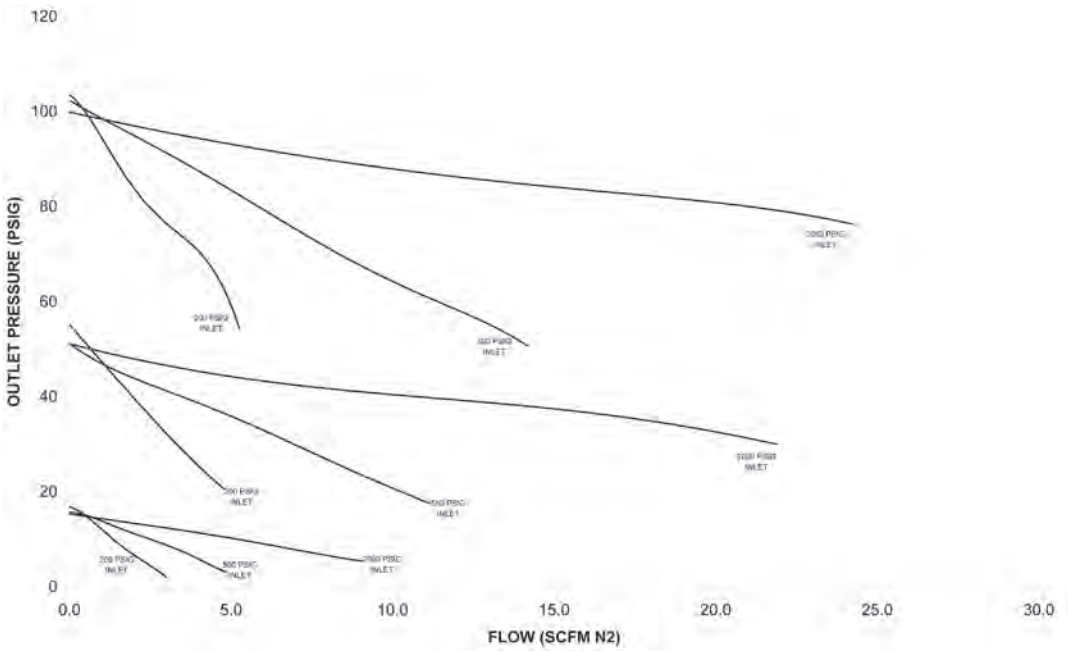
Ordering Information

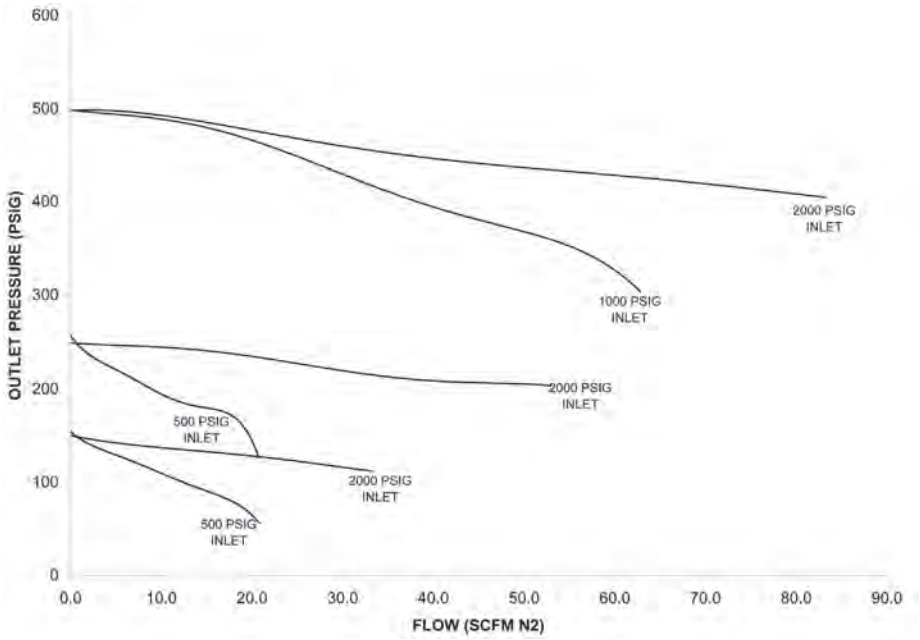
Part Number	Description
PRS6D000	200 Pre-moistened lens cleaning towelettes

Ordering Information

Part Number	Description
PRS6D001	Disposable lens cleaning station

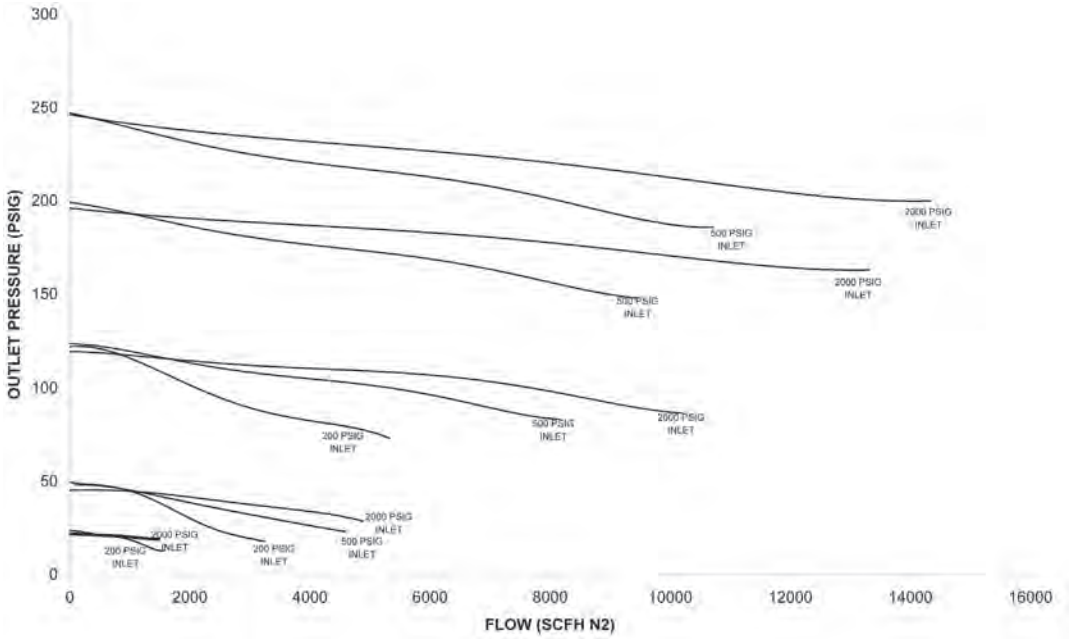
Models PRS3002, PRS3004, PRS3022, PRS3024, PRS4002, PRS4005, PRS4025 and PRS4022





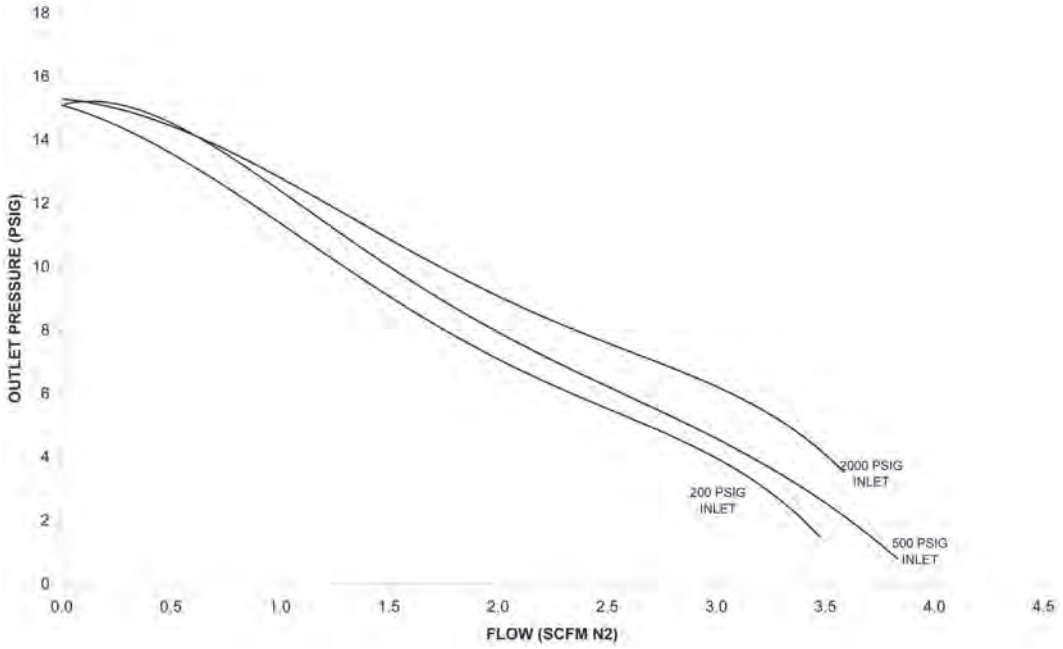
Regulator Flow Curves

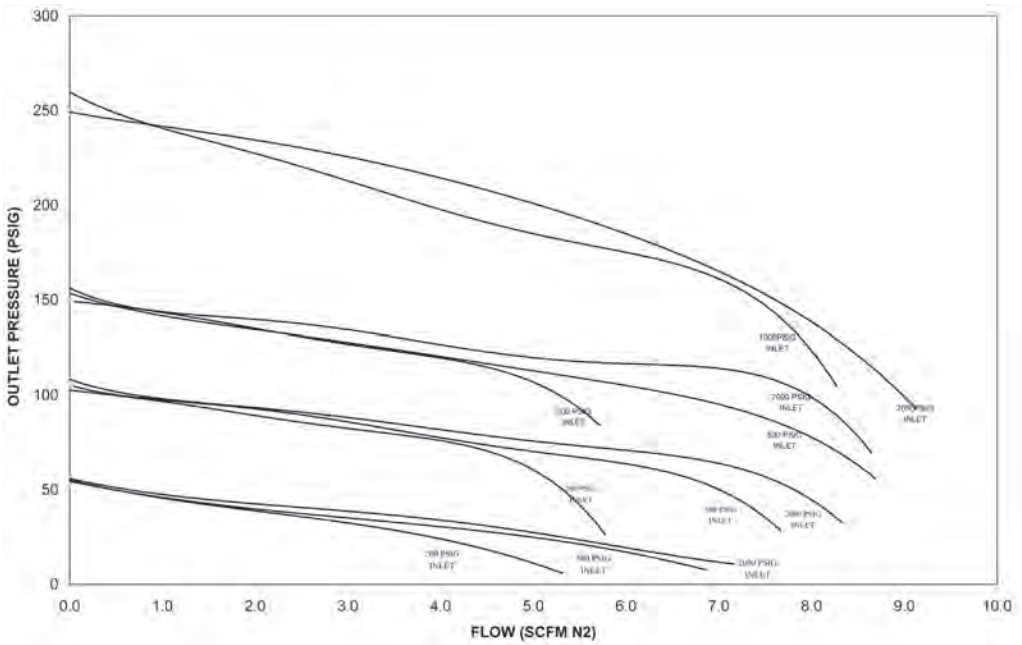
Models PRS4083, PRS4084, PRS4085, and PRS4086



Models PRS4012, PRS4032, PRS3012, and PRS3032

Regulator Model	Page Number	Regulator Model	Page Number
PRS4012	E•244	PRS3012	E•250
PRS4032	E•247	PRS3032	E•253





Section

F

Safety Information

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In this section

- **Safety Data Sheets*, including Praxair's new *Chemmate®* custom SDS for mixtures**
- **Personal protective equipment**
- **Receiving cylinders and containers**
- **Testing for leaks**
- **Moving cylinders and containers**
- **Storing cylinders and containers**
- **Opening and closing valves**

* Formerly known as Material Safety Data Sheets

Fax on Demand!
SDSs Available,
Fast and Easy by Calling
1-877-PRAXAIR
or
Visit Our Website
www.praxair.com/msds
for easy downloads.

General Safety Information

Safety Data Sheets

A Safety Data Sheet (SDS) formerly known as a Material Safety Data Sheet lists the characteristics and hazards of a specific hazardous industrial material. SDSs tell how to handle, store, and ship the material safely and in accordance with regulations. They also give emergency and first aid procedures for dealing with injuries, fires, leaks, spills, and other incidents involving the material. Praxair SDSs provide additional information such as ratings under various hazard identification systems, listing by certain states, and valve connection data.

Under the OSHA Hazard Communication Standard, manufacturers of hazardous materials must prepare and make available an SDS for each hazardous material sold. In addition, those purchasing these materials must maintain a file of SDSs in the work place so they are available to their employees.

Precautionary information on the safe handling of gases listed in this catalog is provided on Safety Data Sheets (SDS), which are issued to customers for each product sold.

We strongly urge you to read and thoroughly understand the information contained in the applicable SDS before using any of the gases in this catalog.

Copies of SDS's can be obtained thru your Sales Representative, by calling Praxair at 1-800-PRAXAIR or visiting our website at www.praxair.com/resource-library/sds.

Personal Protective Equipment

The type of personal protective equipment required at a particular location depends on the products handled at that location. For personal protective equipment recommendations, read the SDS for each product handled at your location. Personal protective equipment, available from local safety equipment suppliers, should be selected in accordance with standards established by OSHA or NIOSH.

Receiving Cylinders and Containers

External Inspection

Personnel responsible for receiving cylinders and containers should perform an external inspection on all packages before moving them to the point of use or to the storage area. Basic guidelines for performing this inspection are as follows:

- Read the cylinder labels to be sure that the gas is what you ordered and that you understand the hazards associated with the product. Remember, the label is the only means of identifying the product in the cylinder. Never identify the product by the color of the cylinder.
- Check the TC/DOT cylinder markings to be sure you understand the pressures contained in the cylinders.
- Thoroughly inspect the cylinders for any obvious damage. The cylinder surface should be clean and free from defects such as cuts, gouges, burns and obvious dents. Such damage could weaken the cylinder metal, creating a danger of failure, or it could make the cylinder unstable and more likely to tip over. Make sure the cylinder stands steady on its base and does not wobble.
- Cylinders with neck threads should have a cap in place over the valve. Remove the cap by hand. Never use a screw driver, crowbar, or other leverage device to remove the cap. You could accidentally open the valve or damage it.
- Check the cylinder valve to be sure it is not bent or damaged. A damaged valve could leak or fail, or it might not make a tight connection when the cylinder is placed into use. Make sure the valve is free of dirt and oil, which could contaminate the gas. Dirt particles propelled in a high-velocity gas stream could cause a spark, igniting a flammable gas. Oil and grease can react with oxygen and other oxidizers, causing an explosion.
- If any cylinder is received with missing or unreadable labels and markings; visible damage; an unstable base; a missing cap; or a bent, damaged, or dirty valve, do not use the cylinder. Contact your supplier and ask for instructions.

Testing for Leaks

After completing the external inspection, proceed as follows:

- Test the cylinder valve for leaks using the leak test method approved by your employer. If you detect leakage, follow your employer's procedures for handling leaking cylinders.

Note: It is normal for cryogenic liquid containers to vent through their relief valves to relieve excess pressure build up due to heat. This venting is not a leak.

- If no leakage is detected, secure the cylinder valve cap in place before moving the cylinder to the point of use or to the storage area.

Moving Cylinders and Containers

Cylinders and containers must always be moved carefully. Mishandling that results in a damaged valve or ruptured cylinder can expose personnel to the hazards associated with these gases. In addition, most gas cylinders are heavy and bulky. A cylinder striking someone or pinching a finger, toe, or other extremity is a common cause of injury. For these reasons, all cylinder handlers must always wear certain minimum personal protective equipment prescribed by OSHA:

- Gloves to protect the hands against common pinching injuries.
- Safety glasses to protect the eyes against injuries associated with pressure release.
- Safety shoes with metatarsal supports to protect against foot injuries from falling cylinders.

Before moving a cylinder to the storage area or point of use or before returning the cylinder to the supplier, ensure the following:

- The outlet valve is fully closed.
- The outlet valve dust plug or pressure cap is on tight for cylinders equipped with these protection devices.
- The valve protection cap is properly secured in place on cylinders with neck threads.

Note: Valve caps must always be in place while moving or transporting cylinders or when they are in storage.

While moving full or empty cylinders:

- Always use carts or hand trucks designed for this purpose.
- Never drop cylinders or allow them to strike each other violently.
- Never lift cylinders by the cap or with a lifting magnet.

After moving a cylinder to its point of use, secure the cylinder in place. Use cylinder stands, clamps, or other securing devices recommended by your supplier.

Storing Cylinders and Containers

Storage of compressed gas cylinders and cryogenic liquid containers is governed by codes of the National Fire Protection Association (NFPA). Local codes may also apply. Know and obey codes governing storage at your location.

Safe Practices

In general, store cylinders so they can't be easily toppled over. Remember, danger exists not only from accidental release of gas by cylinders damaged in a fall but also from their striking someone and causing injury. Store cylinders upright in compact groups, interlocking them so that each cylinder physically contacts those around it. Do not stand cylinders loosely or in a haphazard manner.

A single cylinder that topples over can create a domino effect causing other cylinders to fall. Single cylinders should be secured in place or on a cylinder cart so they can't be readily knocked over.

Keep stored cylinders out of high traffic areas. Do not store them near the edges of platforms. Avoid storage in areas where there are activities that could damage or contaminate the cylinders. Electric arc welding can destroy the integrity of cylinder metal if a welder carelessly strikes an arc on a cylinder. Overhead hoists can drip oil or grease on cylinders, contaminating them. Never store cylinders with flammable materials.

Refer to Section E for our full line of safety apparatus (pages E•389 - E•404) and gas detection systems (pages E•405 - E•409).

Opening and Closing Valves

Observing a few simple rules when opening and closing valves can prevent damage to valves and equipment and add years of useful service life to the valves. The proper way to open any cylinder valve is to first crack the valve, then open it slowly by turning the handle or stem counterclockwise. This allows equipment to gradually adjust to full pressure. Stop turning as soon as there is any resistance. Turning the valve handle or stem too far in the open position can jam the stem causing damage and leaks and preventing later closure.

Likewise, overtightening when closing a valve can damage or permanently distort the seat and result in leakage. Typical closing torques are as follows:

Packed Stem Valve	30 to 40 ft-lb
Diaphragm Seal Valve	85 to 96 in-lb
Pressure Seal Valve	60 to 85 in-lb
Pin-Indexed Valve	20 to 25 in-lb

Caution: Never open a cylinder valve that is not connected to a pressure regulating device.

Specific Guidelines

The compressed gases and cryogenic liquids presented on the following pages are organized in product categories having similar health hazards and storage requirements. These categories are as follows:

- Nonflammable, Non-corrosive, Low Toxicity (Table 1)
- Flammable, Non-corrosive, Low Toxicity (Table 2)
- Flammable, Corrosive, and/or Toxic (Table 3)
- Toxic and/or Corrosive, Nonflammable (Table 4)
- Spontaneously Flammable (Table 5)
- Toxic (Table 6)

Table 1

Nonflammable, Non-corrosive, Low Toxicity. Store these products in well-ventilated areas or in covered outdoors areas, keeping them off the ground and away from radiant heat sources. Cylinder temperatures should not exceed 125 °F (52 °C).

Note: Nonflammable, Non-corrosive, Low Toxicity products listed in Table 1 can be safely stored together with Toxic and/or Corrosive, Nonflammable products listed in Table 4.

- Air
- Argon
- Banana Gas 32
- Carbon Dioxide
- Clinical Blood Gas Mixtures
- P-5 Electron Capture Mixture
- 8.5% Hydrogen/Helium
- Halocarbon 14
- Halocarbon 22
- Halocarbon 23
- Halocarbon 116
- Halocarbon 218
- Halocarbon 134A
- Helium
- Krypton
- Neon
- Nitrogen
- Nitrous Oxide
- Oxygen
- Sulfur Hexafluoride
- Xenon

Table 2

Flammable, Non-corrosive, Low Toxicity. Store these products in well-ventilated areas equipped with electrical equipment in accordance with Article 500 of the National Electrical Code. These products may also be stored in covered outdoor areas, but keep them off the ground and away from radiant heat sources. Keep all ignition sources and combustible materials out of the storage area. Cylinder temperature should not exceed 125 °F (52 °C).

Note: Flammable, Non-corrosive, Low Toxicity products listed in Table 2 can be safely stored together with Flammable, Corrosive, and/or Toxic products listed in Table 3.

- Acetylene
- Butane
- Deuterium
- Ethane
- Ethylene
- Hexane
- 1-Hexene
- Hydrogen
- Isobutane
- Isobutylene
- Methane
- Propane
- Propylene
- Toluene
- Xylenes (o-,m-,p-)

Table 3

Flammable, Corrosive, And/Or Toxic. Store these products in well-ventilated areas equipped with electrical equipment in accordance with Article 500 of the National Electrical Code. These products may also be stored in covered outdoor areas, but keep them off the ground and away from radiant heat sources. Keep all ignition sources and combustible materials out of the storage area. Cylinder temperature should not exceed 125 °F (52 °C).

Note: Flammable, Corrosive, and/or Toxic products listed in Table 3 can be safely stored together with Flammable, Non-corrosive, Low Toxicity products listed in Table 2.

- 1,3-Butadiene
- Carbon Monoxide
- Carboxide, 10% Ethylene Oxide – 90% Carbon Dioxide Mixture
- Dichlorosilane
- Dimethylamine
- Ethyl Chloride
- Ethylene Oxide
- Hydrogen Sulfide
- Methyl Chloride
- TEOS
- Trichlorosilane

Table 4

Toxic And/Or Corrosive, Nonflammable. Store these products in well-ventilated areas or in covered outdoor areas, but keep them off the ground and away from radiant heat sources. Cylinder temperature should not exceed 125 °F (52 °C).

Note: Nonflammable, Non-corrosive, Low Toxicity products listed in Table 1 can be safely stored together with Toxic and/or Corrosive, Nonflammable products listed in Table 4.

- Ammonia
- Boron Trichloride
- Boron Trifluoride
- Boron[11] Trifluoride
- Chlorine
- Hydrogen Bromide
- Hydrogen Chloride
- Hydrogen Fluoride
- Nitrogen Trifluoride
- Silicon Tetrachloride
- Sulfur Dioxide

Table 5

Spontaneously Flammable. Store these products in well-ventilated areas or in covered outdoor areas, but keep it off the ground and away from radiant heat sources. Keep combustible materials out of the storage area. Cylinder temperatures should not exceed 125°F (52°C).

Warning: Do not store Spontaneously Flammable products with products in any other hazard category.

- Disilane
- Silane
- Trimethylboron

Table 6

Toxic. These products are very toxic. The slightest exposure to these products can kill. Preferably, store these toxic gases outdoors in a fenced-in area that has been locked and posted. This area must be covered with the cylinders kept off the ground and away from radiant heat sources. If stored indoors, toxic gas cylinders must be kept in well-ventilated areas. Cylinder temperatures should not exceed 125 °F (52 °C).

In addition to being toxic, arsine, diborane, and phosphine are also flammable. The storage area for flammable toxic gases should have electrical equipment conforming to Article 500 of the National Electrical Code. Space all ignition sources and combustible materials out of storage areas.

Warning: Do not store Toxic products with products in any other hazard category.

- Arsine
- Diborane
- Diethyltelluride
- Germane
- Germanium Tetraflouride
- Hydrogen Selenide
- Nitric Oxide
- Nitrogen Dioxide
- Phosphine
- Tungsten Hexafluoride

Get to Know Praxair Specialty Gases

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Comprehensive, High-Quality Product Line

A full range of certified gases, mixtures, gas handling equipment and related services.

Application-Based Solutions

Sales, production and research capabilities and the ability to supply end use customers, OEMs and research institutes with a safe, accurate and precise product worldwide.

Reliable Production and Distribution Network

Twenty-six specialty gases laboratories and production centers, hundreds of distribution locations in North America and Praxair's own delivery fleet – all serving you with the gases you need when you need them.

Outstanding Technical Support

A highly trained team of field sales representatives, technical service personnel and production chemists, in concert with dedicated market specialists who quickly provide the guidance and support our prospects and customers need to resolve regulatory, technical and safety application issues.

Worldwide Coverage

Application-based research and development at five international technical centers, combined with specialty gases production and distribution in over 40 countries.

Section

G

Technical Data

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In this section

Materials Compatibility

Gas Compatibility

The compatibility data shown on pages 2 and 3 of this Section G have been compiled to assist in evaluating appropriate materials for use in handling various gases. It is extremely important that all gas control equipment be compatible with the gas being used. The use of a device that is not compatible may damage the unit and cause a leak that could result in property damage or personal injury. To reduce potentially harmful situations, always check for the compatibility of equipment and materials before using any gases in your gas control equipment.

Since combinations of gases are virtually unlimited, mixtures (except for Oxyfume® and Medifume® sterilizing gas mixtures) are not listed in the Compatibility Chart. Before using a gas mixture or any gas not listed in the chart, we strongly urge you to contact Praxair for information.

Directions

To use the compatibility chart on the following pages, proceed as follows:

1. Locate the gas you are using in the first column of the chart.
2. Check the materials of construction you intend to use. Materials of Construction have been grouped by metals, plastics and elastomers.
3. Refer to the applicable “Key to Materials Compatibility Symbol”.
4. Verify that the “Key to Materials Compatibility Symbol” allows this combination and that the application is satisfactory.

Key to Materials Compatibility

S – Satisfactory for use with the intended gas.

C – Conditional. May be incompatible under some circumstances or conditions. Contact your Praxair representative for additional information.

U – Unsatisfactory for use with the intended gas.

I – Insufficient data available to determine compatibility with the intended gas.

O – All nonmetalic, even those considered compatible, may be ignitable in oxygen enriched environments or in other oxidizing gases. Successful use depends upon oxygen purity, pressure, temperature, cleanliness and elimination of ignition mechanisms. Please contact your Praxair Representative for additional information.

Important

This information contained in this Section G is prepared for the use of experienced operators who know the general principles and the safety precautions to be observed in handling specialty gases and associated equipment. If you are not certain you fully understand these safety precautions, we urge you to obtain and read the applicable Safety Data Sheet (SDS) and Equipment Instruction Booklet, and speak to your supplier about appropriate precautions.

The information contained in the Compatibility Chart has been compiled by Praxair from what it believes are authoritative sources and it is offered solely as a convenience to customers. While Praxair believes that this information is accurate and factual as of the date of this publication, this information is intended to be used only as a guide in providing general information with respect to the products mentioned; and, therefore, it is not to be taken as a warranty or representation for which Praxair assumes legal responsibility.

Since the user’s product formulation, specific use application, and conditions of use are all outside Praxair’s control, Praxair makes no warranty or representation regarding the results which may be obtained by the user. It is the user’s responsibility to determine the suitability of the gas control and gas.

Materials Compatibility

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Common Name	Chemical Formula	Materials of Construction																		
		Metals							Plastics						Elastomers					
		Brass	Carbon Steel	Stainless Steel	Aluminum	Zinc	Copper	Monel	Kel-F®	Teflon®	Tefzel®	Kynar®	PVC	Polycarbonate	Kalrez®	Viton®	Buna-N	Neoprene	Polyurethane
Acetylene	C_2H_2	C	S	S	S	U	U	S	S	S	S	S	I	I	S	U	U	U	U
Air	–	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Ammonia	NH_3	U	S	S	S	U	U	S	S	S	S	U	I	I	C	U	C	S	I
Argon	Ar	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Arsine	AsH_3	S	C	S	C	I	S	S	S	S	S	S	S	I	S	S	S	S	U
Boron Trichloride	BCl_3	U	S	S	U	I	S	S	S	S	S	S	S	I	C	S	U	U	I
Boron Trifluoride	BF_3	S	S	S	C	I	S	S	S	S	S	S	S	I	C	S	U	U	I
1,3-Butadiene	C_4H_6	S	S	S	C	S	S	S	S	S	S	S	S	U	I	S	U	U	U
Butane	C_4H_{10}	S	S	S	C	S	S	S	S	S	S	S	S	U	S	S	S	S	S
1-Butene	C_4H_8	S	S	S	C	S	S	S	S	S	S	S	S	U	S	S	S	U	S
Carbon Dioxide	CO_2	S	S	S	S	S	S	S	S	S	S	S	S	U	S	S	U	U	S
Carbon Monoxide	CO	S	C	S	C	S	S	S	S	S	S	S	S	S	S	S	S	U	S
Chlorine	Cl_2	U	S	S	U	U	U	S	S	S	S	S	U	U	S	S	U	U	U
Deuterium	D_2	S	C	S	C	S	S	S	S	C	S	S	S	I	S	S	S	S	S
Diborane	B_2H_6	S	C	S	C	I	S	S	S	S	S	S	S	I	S	I	I	I	I
Dichlorosilane	H_2SiCl_2	S	S	S	U	I	S	S	S	S	S	S	I	I	I	S	S	S	I
Disilane	Si_2H_6	S	C	S	C	I	S	S	S	S	S	S	S	U	I	S	I	S	I
Ethane	C_2H_6	S	S	S	C	S	S	S	S	S	S	S	S	I	S	S	S	U	S
Ethylene	C_2H_4	S	S	S	C	S	S	S	S	S	S	S	I	I	S	S	S	S	I
Halocarbon 14	CF_4	S	S	S	C	I	S	S	I	S	I	S	I	I	I	S	S	S	I
Halocarbon 22	$CHClF_2$	S	S	S	C	I	S	S	S	C	S	S	U	U	C	U	U	C	U
Halocarbon 23	CHF_3	S	S	S	C	I	S	S	S	S	I	S	I	I	I	S	I	I	I
Halocarbon 116	C_2F_6	S	S	S	C	S	S	S	S	S	S	S	U	U	C	S	S	S	S
Halocarbon 134A	CH_2FCF_3	S	S	S	C	I	S	S	I	I	I	I	I	I	I	I	U	U	I
Halocarbon 218	C_3F_8	S	S	S	C	I	S	S	S	S	S	I	I	I	I	S	S	S	I
Helium	He	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Hydrogen	H_2	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Hydrogen Bromide	HBr	U	S	S	U	U	U	S	I	S	I	S	I	I	I	U	U	U	I
Hydrogen Chloride	HCl	U	S	S	U	U	U	S	S	S	S	S	S	U	S	U	U	U	U
Hydrogen Sulfide	H_2S	U	C	S	C	I	I	S	S	S	S	S	U	S	S	U	U	U	S

Note:
This chart has been prepared for use with dry (anhydrous) gases at normal operating temperature of 70 °F (21 °C). Information may vary if different operating conditions exist. Systems and equipment used in oxidizer gas service (e.g., Oxygen or Nitrous Oxide) must be cleaned for oxygen service.

Materials Compatibility

Common Name	Chemical Formula	Materials of Construction																	
		Metals							Plastics						Elastomers				
		Brass	Carbon Steel	Stainless Steel	Aluminum	Zinc	Copper	Monel	Kel-F®	Teflon®	Tefzel®	Kynar®	PVC	Polycarbonate	Kalrez®	Viton®	Buna-N	Neoprene	Polyurethane
Isobutane	C_4H_{10}	S	S	S	C	S	S	S	S	S	S	S	S	U	S	S	S	S	S
Isobutylene	C_4H_8	S	S	S	C	I	S	S	S	S	S	S	S	U	S	S	S	U	I
Krypton	Kr	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Medifume™ Mixture	–	C	S	S	I	I	U	I	S	S	I	I	U	U	C	S	S	S	S
Methane	CH_4	S	S	S	C	S	S	S	S	S	S	S	S	I	S	S	S	S	S
Methyl Chloride	CH_3Cl	S	S	S	U	U	S	S	S	S	S	S	I	I	S	S	U	U	U
Neon	Ne	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Nitric Oxide	NO	U	S	S	C	I	S	S	S	S	S	S	S	S	S	S	U	U	I
Nitrogen	N_2	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S
Nitrogen Dioxide	NO_2	U	S	S	C	I	U	S	S	S	S	U	U	I	C	U	U	U	U
Nitrogen Trifluoride	NF_3	C	C	C	U	C	C	C	C	C	I	C	I	I	I	I	I	I	I
Nitrous Oxide	N_2O	S	S	C	C	S	S	S	O	O	C	O	O	I	C	O	U	U	U
Oxygen	O_2	S	C	O	C	S	S	S	O	O	O	O	O	C	O	U	O	O	O
Oxyfume® Mixtures	–	C	S	S	C	I	U	I	S	S	I	I	U	U	C	U	U	U	U
Pentane	C_5H_{12}	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S			
Phosphine	PH_3	S	C	S	C	U	I	S	S	S	S	S	I	I	U	S	S	S	S
Propane	C_3H_8	S	S	S	C	S	S	S	S	S	S	S	S	U	I	S	S	U	I
Propylene	C_3H_6	S	S	S	C	S	S	S	S	S	S	S	S	U	S	S	U	U	U
Silane	SiH_4	S	C	S	C	I	S	S	S	S	S	S	S	I	I	S	S	S	I
Silicon Tetrachloride	$SiCl_4$	C	S	S	C	I	U	S	S	S	I	S	U	I	C	S	U	U	I
Sulfur Dioxide	SO_2	C	S	S	C	U	U	S	S	S	S	S	S	I	S	U	U	U	S
Sulfur Hexafluoride	SF_6	S	S	S	S	I	S	S	S	S	S	S	S	I	C	S	S	S	S
Trichlorosilane	$HSiCl_3$	S	S	S	U	I	I	S	S	S	I	I	U	I	C	S	U	U	I
Tungsten Hexafluoride	WF_6	I	C	C	U	U	I	S	I	C	C	C	C	I	I	I	U	U	I
Xenon	Xe	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S	S

Note:
This chart has been prepared for use with dry (anhydrous) gases at normal operating temperature of 70 °F (21 °C). Information may vary if different operating conditions exist. Systems and equipment used in oxidizer gas service (e.g., Oxygen or Nitrous Oxide) must be cleaned for oxygen service.

Conversion Factors

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Density	To Obtain				
	g/ml	kg/m³	lb/ft³	lb/in³	lb/U.S. gal
	Multiply By				
g/ml	–	1000	62.428	0.0361273	8.3454
kg/m³	0.001	–	0.062428	3.61273×10^{-5}	0.0083454
lb/ft³	0.0160185	16.018463	–	5.78704×10^{-4}	0.13368
lb/in³	27.679905	27,679.9	1728	–	231
lb/U.S. gal	0.1198264	119.8264	7.4805195	0.004329	–

Flow	To Obtain							
	cm³/min	cm³/sec	ft³/hr	ft³/min	m³/hr	m³/min	L/hr	L/min
	Multiply By							
cm³/min	–	0.0166667	0.0021189	0.0000353	0.00006	0.000001	0.06	0.001
cm³/sec	60	–	0.127134	0.0021189	0.0036	0.00006	3.6	0.06
ft³/hr	471.9474	7.86579	–	0.0166667	0.0283168	0.0004719	28.31685	0.4719474
ft³/min	28,316.85	471.9474	60	–	1.699008	0.0283168	1699.008	28.31685
m³/hr	16,666.67	277.7778	35.31467	0.5885777	–	0.0166667	1000	16.66667
m³/min	1,000,000	16,666.67	2118.876	35.31467	60	–	60,000	1000
L/hr	16.66667	0.2777778	0.0353147	0.0005885	0.001	0.0000167	–	0.0166667
L/min	1000	16.66667	2.118876	0.0353147	0.06	0.001	60	–

Length	To Obtain							
	Å	cm	ft	in	m	mm	micron	yd
	Multiple By							
Å	–	1×10^{-8}	$3.2808399 \times 10^{-10}$	3.3937008×10^{-9}	1×10^{-10}	0.0000001	0.0001	$1.0936133 \times 10^{-10}$
cm	1×10^{8}	–	0.0328084	0.3937008	0.01	10	10,000	0.0109361
ft	3.048×10^{9}	30.48	–	12	0.3048	304.8	304,800	0.3333333
in	2.54×10^{8}	2.54	0.0833333	–	0.0254	25.4	25,400	0.0277778
m	1×10^{10}	100	3.2808399	39.3700787	–	1,000	1,000,000	1.0936133
mm	10,000,000	0.1	0.00328084	0.03937008	0.001	–	1,000	0.0010936
micron	10,000	0.0001	3.2808399×10^{-6}	3.9370079×10^{-5}	0.0000010	0.001	–	1.0936133×10^{-6}
yd	9.144×10^{9}	91.44	3	36	0.9144	914.4	914,400	–

Pressure	To Obtain									
	micron (µm Hg)	mm of Hg at 0 °C (torr)	atm	psi	bar	kg/cm²	kPa	ft of H_2O at 60 °F	in of H_2O at 60 °F	in of Hg at 0 °C
	Multiple By									
micron (µm Hg)	–	1.0×10^{-3}	1.31579×10^{-6}	1.9337×10^{-5}	1.33×10^{-6}	1.30×10^{-6}	1.333×10^{-4}	4.4603×10^{-5}	5.3524×10^{-4}	3.937×10^{-5}
mm of Hg (0 °C) (torr)	1,000	–	0.00132	0.019337	0.001333	0.001360	0.133322	0.044603	0.535240	0.03937
atm	760,000	760	–	14.696	1.01325	1.0332	101.3171	33.932	407.1827	29.921
psi	51,714	51.715	0.06805	–	0.068948	0.070307	6.89465	2.3089	27.70851	2.0360
bar	750,187	750.062	0.98692	14.50368	–	1.019716	100	33.4883	401.8596	29.530
kg/cm²	769,231	735.5592	0.96787	14.22334	0.980665	–	98.03922	32.8084	393.7008	28.95903
kPa	7,501.87	7.5006	0.00987	0.14504	0.010	0.01020	–	0.33456	4.01472	0.2613
ft of H_2O (60 °F)	22,420	22.4198	0.02947	0.433107	0.029891	0.03048	2.9890	–	12	0.882646
in of H_2O (60 °F)	1,868.32	1.86832	0.00246	0.03609	0.002499	0.00254	0.249089	0.083333	–	0.073556
in of Hg (0 °C)	25,400	25.4	0.03342	0.49115	0.033664	0.034532	3.376895	1.1340	13.6	–

Conversion Factors

Temperature	To Obtain			
	Celsius, °C	Fahrenheit, °F	Kelvin, °K	Rankine, °R
	Multiply By			
Celsius, °C	–	°F = (°C x 1.8) + 32	°K = °C + 273.16	°R = (°C + 273.16) x 1.8
Fahrenheit, °F	°C = (°F - 32)/1.8	–	°K = (°F -32)/1.8) + 273.16	°R = °F + 459.69
Kelvin, °K	°C = °K - 273.16	°F = ((°K - 273.16) x 1.8) + 32	–	°R = °K x 1.8
Rankine, °R	°C = (°R/1.8) - 273.16	°F = °R - 459.69	°K = °R/1.8	–

Volume	To Obtain						
	cm^3*	ft^3	in^3	m^3	gal (U.S. Liquid)	L	gal (Imperial)
	Multiply By						
cm^3*	–	0.00003531	0.0610237	0.000001	0.0002641	0.001	0.0002199
ft^3	28,316.847	–	1728	0.02831685	7.480519	28.316847	6.229
in^3	16.387064	0.0005787	–	0.00001637	0.0043290	0.0163871	0.003605
m^3	1,000,000	35.31467	61,023.74	–	264.172	1000	220.0
gal (U.S. Liquid)	3785.4123	0.13368056	231	0.00378541	–	3.785412	0.8327
L	1000	0.03531467	61.02374	0.001	0.2641721	–	0.2200
gal (Imperial)	4546.10	0.1605	277.40	0.004546	1.201	4.546	–

* 1 cm^3 = 1 ml

Mass and Weight	To Obtain						
	mg	g	kg	oz*	lb*	ton (short, U.S.)	ton (long, metric)
	Multiply By						
mg	–	0.001	0.000001	3.5274×10^{-5}	2.2046×10^{-8}	1.102×10^{-9}	1×10^{-9}
g	1000	–	0.001	0.0352740	0.0022046	1.102×10^{-8}	1×10^{-6}
kg	1,000,000	1000	–	35.273962	2.2046226	0.0011023	1×10^{-3}
oz*	28,349.5	28.34952	0.0283495	–	0.0625	3.125×10^{-5}	2.83×10^{-5}
lb*	453,592	453.59237	0.4535924	16	–	0.0005	4.535×10^{-4}
ton (short, U.S.)	9.07185×10^{8}	907.185	907.18474	32,000	2000	–	0.907
ton (long, metric)	1×10^{9}	1×10^{6}	1000	35,274	2205	1.102	–

*avoirdupois

Concentration Equivalents

Concentration		Equivalent
1,000,000 ppm	=	100.00%
100,000 ppm	=	10.0%
10,000 ppm	=	1.0%
1,000 ppm	=	0.1%
100 ppm	=	0.01%
10 ppm	=	0.001%
1 ppm	=	0.0001%

Concentration		Equivalent
1,000 ppb	=	1 ppm
100 ppb	=	0.1 ppm
10 ppb	=	0.01 ppm
1 ppb	=	0.001 ppm
1,000 ppt	=	0.001ppm
100 ppt	=	0.0001ppm
10 ppt	=	0.00001ppm
1 ppt	=	0.000001ppm
1,000 ppt	=	1 ppb
100 ppt	=	0.1 ppb
10 ppt	=	0.01 ppb
1 ppt	=	0.001 ppb

Exponential Equivalents

Scientific Notation	Equivalent Notation
1×10^{10}	10,000,000,000
1×10^{9}	1,000,000,000
1×10^{8}	100,000,000
1×10^{7}	10,000,000
1×10^{6}	1,000,000
1×10^{5}	100,000
1×10^{4}	10,000
1×10^{3}	1,000
1×10^{2}	100
1×10^{1}	10
1×10^{0}	1

Scientific Notation	Equivalent Notation
1×10^{0}	1
1×10^{-1}	0.1
1×10^{-2}	0.01
1×10^{-3}	0.001
1×10^{-4}	0.0001
1×10^{-5}	0.00001
1×10^{-6}	0.000001
1×10^{-7}	0.0000001
1×10^{-8}	0.00000001
1×10^{-9}	0.000000001
1×10^{-10}	0.0000000001

Physical Properties

PRAXAIR
Making our planet more productive

Name	Gas Density (NTP)		Boiling Point		Critical Press		Critical Temperature		Mole Weight	Specific Volume		Specific Gravity
	lb/ft³	kg/m³	°F	°C	psia	bar	°F	°C		ft³/#	m³/kg	(air=1)
Acetylene	0.0733 a	1.17 a	-119.2	-84.0	897.8	63.1	95.36	35.20	26.04	14.43	0.901	0.9080
Air	0.0807 a	1.29 a	-317.8	-194.4	547.4	38.5	-221.08	-140.60	28.85	13.30	0.830	1.0000
Ammonia	0.0450	0.72	-28.1	-33.4	1636.1	115.0	270.32	132.40	17.03	22.60	1.411	0.5970
Argon	0.1034	1.66	-302.6	-185.9	705.4	49.6	-188.32	-122.40	39.95	9.67	0.604	1.3780
Arsine	0.2000	3.20	-80.5	-62.5	957.0	67.3	211.82	99.90	77.95	5.00	0.312	2.6900
Boron Trichloride	0.3030	4.85	54.3	12.4	561.4	39.5	353.84	178.80	117.17	3.30	0.206	4.0300
Boron Trifluoride	0.179	2.87	-147.6	-99.8	723.0	50.8	10.04	-12.20	67.81	5.60	0.350	2.3870
Butadiene, 1,3-	0.1516 a	2.43 a	24.1	-4.4	627.5	44.1	305.60	152.00	54.09	6.90	0.431	1.8780
Butane, n-	0.1588	2.54	31.1	-0.5	545.0	37.5	305.60	152.00	58.12	6.40	0.400	2.1100
Butene, 1-	0.1477 b	2.37 b	20.7	-6.3	583.4	41.0	295.52	146.40	56.12	6.70	0.418	1.9970
Carbon Dioxide	0.1140 a	1.83 a	-109.1	-78.4	1070.6	75.3	87.80	31.00	44.01	8.76	0.5471	1.5220
Carbon Monoxide	0.0781 a	1.25 a	-312.7	-191.5	508.0	35.0	-219.6	-139.8	28.01	13.80	0.862	0.9670
Chlorine	0.1859	2.98	-29.3	-34.1	1118.4	78.6	291.20	144.00	70.91	5.40	0.337	2.4900
Deuterium	0.0112	0.18	-417.1	-249.5	239.2	16.8	-390.82	-234.90	4.03	95.90	5.987	0.1497
Dichlorosilane	0.2601	4.17	46.8	8.2	678.2	47.7	348.80	176.00	101.01	3.83	0.239	3.4800
Disilane	0.1790	2.87	6.3	-14.3	747.2	52.5	303.53	150.85	62.22	6.21	0.388	2.3800
Ethane	0.0775 b	1.24 b	-127.5	-88.6	712.8	50.1	90.32	32.40	30.07	12.80	0.799	1.0480
Ethylene	0.0787 a	1.26 a	-154.7	-103.7	742.1	52.2	49.82	9.90	28.05	13.80	0.862	0.9750
Halocarbon-14	0.2280	3.65	-198.3	-127.9	542.4	38.1	-50.30	-45.7	88.00	4.39	0.274	3.0380
Halocarbon-22	2.4802	3.7182	-41.0	-41.0	716.0	49.3	204.80	96.00	86.47	4.40	0.275	3.9000
Halocarbon-23	0.1820	2.92	-115.6	-82.0	697.0	49.0	78.26	25.70	70.01	5.50	0.343	2.4000
Halocarbon-116	0.3608	5.78	-108.8	-78.2	455.0	31.3	67.50	19.70	138.01	2.80	0.175	4.7730
Halocarbon-134A	1.7966	7.50 b	-15.7	-26.5	589.6	41.5	213.98	101.10	102.03	3.52	0.134	3.6000
Halocarbon-218	0.5000	8.01	-34.06	-36.7	388.7	27.3	161.42	71.90	188.02	2.02	0.126	6.5000
Halocarbon-C318	0.55	8.82	21.56	-5.8	403.3	27.8	238.6	114.8	200.03	1.85	0.12	7.0000
Helium	0.0103	0.16	-452.1	-268.9	33.2	2.3	-450.40	-268.00	4.00	96.60	6.031	0.1380
Hexane, n-	0.2228	3.569	155.66	68.7	430.6	29.7	453.6	234.2	86.18	4.996	0.31	0.66
Hydrogen	0.0050	0.08	-423.0	-252.8	188.1	13.2	-399.82	-239.90	2.02	191.70	11.968	0.0696
Hydrogen Bromide	0.2080	3.33	-88.1	-66.7	1234.5	85.0	193.64	89.80	80.92	4.80	0.300	2.81
Hydrogen Chloride	0.0943	1.510	-121.0	-85.0	1197.7	82.5	124.5	51.4	36.46	10.6	0.66	1.27
Hydrogen Sulfide	0.0890	1.43	-76.5	-60.3	1306.5	91.9	212.72	100.40	34.08	11.23	0.701	1.1890

Note: Density: a = 0 °C b = 25 °C All others at NTP

Physical Properties

Name	Chemical Formula	2013 TLV		Flammable Range		Odor	IDLH ppm
		ppm	mg/m³	LEL air	UEL air		
Acetylene	C_2H_2	Simple Asphyxiant		2.5	100	Ethereal	
Air	N/A	N/A	N/A	N/A	N/A	None	
Ammonia	NH_3	25	17	16	25	Pungent, Irritating	300
Argon	Ar	Simple Asphyxiant		Nonflammable		None	
Arsine	AsH_3	0.005	0.016	5.1	78	Garlic-like	3
Boron Trichloride	BCl_3	None Established		Nonflammable		Pungent, Irritating	100
Boron Trifluoride	BF_3	C 1.0	C 3.0	Nonflammable		Pungent, Suffocating	25
Butadiene, 1,3-	CH_2:CHCH:CH_2	2.0	4.0	2.0	11.5	Mildly Aromatic	2000
Butane, n-	C_4H_{10}	1000	2377	1.9	8.5	Natural Gas-like	
Butene, 1-	CH_3CH_2CH:CH_2	250	574	1.6	9.3	Natural Gas-like	
Carbon Dioxide	CO_2	5000	9000	Nonflammable		None	40000
Carbon Monoxide	CO	25	29	12.5	74	None	1200
Chlorine	Cl_2	0.5	1.0	Nonflammable		Pungent, Irritating	10
Deuterium	D_2	Simple Asphyxiant		5.0	75	None	
Dichlorosilane	SiH_2Cl_2	None Established		4.1	99	Pungent, Suffocating	100
Disilane	$(SiH_3)_2$	5	13	Unknown, Pyrophoric		Repulsive, Choking	
Ethane	C_2H_6	None Established		3.0	12.5	None	
Ethylene	CH_2:CH_2	200	229	2.7	36	Sweet	
Halocarbon-14	CF_4	None Established		Nonflammable		None	
Halocarbon-22	$CHClF_2$	1000	3537	Nonflammable		Nearly Odorless	
Halocarbon-23	CHF_3	None Established		Nonflammable		None	
Halocarbon-116	C_2F_6	None Established		Nonflammable		None	
Halocarbon-134A	CF_3CH_2F	None Established		Nonflammable		Slightly Ethereal	
Halocarbon-218	C_3F_8	None Established		Nonflammable		Slightly Sweet	
Halocarbon-C318	C_4F_8	None Established		Nonflammable		None	
Helium	He	Simple Asphyxiant		Nonflammable		None	
Hexane, n-	C_6H_{14}	50	176	1.1	7.5	Mild	1100
Hydrogen	H_2	Simple Asphyxiant		4.0	75	None	
Hydrogen Bromide	HBr	C 2.0	C 7	Nonflammable		Irritating	30
Hydrogen Chloride	HCl	C 2.0	C 3	Nonflammable		Pungent, Suffocating	50
Hydrogen Sulfide	H_2S	1	1	4.3	46	Rotten Eggs	100

Physical Properties

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Making our planet more productive

Name	Gas Density (NTP)		Boiling Point		Critical Press		Critical Temperature		Mole Weight	Specific Volume		Specific Gravity
	lb/ft³	kg/m³	°F	°C	psia	bar	°F	°C		ft³/lb	m³/kg	(air=1)
Isobutane	0.1553	2.49	10.9	-11.7	534.0	36.8	275.00	135.00	58.13	6.50	0.406	2.0640
Isobutylene	0.1440 b	2.31 b	19.6	-6.9	580.2	40.8	292.46	144.70	56.12	6.70	0.418	1.9000
Krypton	0.2170	3.48	-244.1	-153.4	796.5	54.9	-82.84	-63.80	83.80	4.61	0.288	2.8990
Methane	0.0448 a	0.72 a	-258.7	-161.5	672.0	46.3	-116.5	-82.5	16.04	23.70	1.480	0.5550
Methyl Chloride	0.1319 b	2.11 b	-11.6	-24.2	966.0	66.5	289.58	143.10	50.49	7.60	0.474	1.7840
Neon	0.0520	0.83	-411.0	-246.1	394.7	27.8	-379.66	-228.70	20.18	19.21	1.199	0.6960
Nitric Oxide	0.0767 b	1.23 b	-241.2	-151.8	949.4	65.4	-135.22	-92.90	30.01	13.00	0.812	1.0360
Nitrogen	0.0725	1.16	-320.4	-195.8	492.2	33.9	-237.82	-149.90	28.01	13.80	0.862	0.9670
Nitrogen Dioxide	0.2119	3.39	70.2	21.2	1469.6	101.2	316.76	158.20	46.01	4.70	0.293	2.6200
Nitrogen Trifluoride	0.1860	2.98	-200.2	-129.0	657.2	45.3	-38.74	-39.30	71.00	5.40	0.337	2.4600
Nitrous Oxide	0.1150	1.84	-127.3	-88.5	1052.2	72.5	97.52	36.40	44.01	8.70	0.543	1.5300
Oxygen	0.0828	1.33	-297.4	-183.0	731.4	51.4	-181.48	-118.60	32.00	12.10	0.755	1.1050
Pentane	0.0116	2.988	96.93	36.07	488.63	33.69	385.7	196.5	72.15	5.4	0.337	2.4910
Phosphine	0.0875	1.40	-125.9	-87.7	947.9	65.3	124.88	51.60	34.00	11.40	0.712	1.1840
Propane	0.1166	1.87	-43.8	-42.1	618.7	42.6	206.24	96.80	44.11	8.50	0.531	1.5500
Propylene	0.1114	1.79	-53.9	-47.7	667.1	46.0	197.24	91.80	42.08	9.06	0.566	1.4800
Silane	0.0837	1.34	-168.7	-111.5	702.5	49.4	25.88	-3.40	32.12	12.04	0.752	1.1140
Silicon Tetrachloride	0.4392	7.08	134.3	56.9	521.1	35.9	452.8	233.8	169.90	2.11	0.142	5.8000
Sulfur Dioxide	0.1666	2.67	14.0	-10.0	1143.5	78.8	315.68	157.60	64.06	5.90	0.368	2.2630
Sulfur Hexafluoride	0.3845	6.16	-82.8	-63.8	545.2	37.6	113.90	45.50	146.05	2.50	0.156	5.5100
Trichlorosilane	0.3500 b	5.61 b	89.6	32.0	604.8	42.0	402.08	205.60	135.45	2.85	0.178	4.7000
Tungsten Hexafluoride	0.7930	12.70	62.6	17.00	629.5	44.3	339.44	170.80	297.84	1.24	0.077	3.4000
Xenon	0.3420	5.48	-162.6	-108.1	846.7	59.5	61.88	16.60	131.30	2.90	0.181	4.5600

Note: Density: a = 0 °C b = 25 °C All others at NTP

Physical Properties

Name	Chemical Formula	2013 TLV		Flammable Range		Odor	IDLH ppm
		ppm	mg/m³	LEL air	UEL air		
Isobutane	$CH(CH_3)_3$	1000	2378	1.8	8.4	Natural Gas-like	
Isobutylene	$(CH_3)_2C:CH_2$	250	574	1.8	9.6	Coal Gas	
Krypton	Kr	Simple Asphyxiant		Nonflammable		None	
Methane	CH_4	None Established		5.0	15	None	
Methyl Chloride	CH_3Cl	50	103	8.1	17.4	Faintly, Sweet Ethereal	2000
Neon	Ne	Simple Asphyxiant		Nonflammable		None	
Nitric Oxide	NO	25	31	Nonflammable		Slightly Irritating	100
Nitrogen	N_2	Simple Asphyxiant		Nonflammable		None	
Nitrogen Dioxide	NO_2	0.2	0.376	Nonflammable		Irritating	20
Nitrogen Trifluoride	NF_3	10	29	Nonflammable		Mold-like	1000
Nitrous Oxide	N_2O	50	90	Nonflammable		Slightly Sweet	
Oxygen	O_2	N/A	N/A	Nonflammable		None	
Pentane, n-	C_5H_{12}	1000	2951	1.5	7.8	Sweet	1500
Phosphine	PH_3	0.30	0.42	1.6	98	Garlic-Like	50
Propane	C_3H_8	None Established		2.1	9.5	Natural Gas-like	2100
Propylene	$CH_2:CHCH_3$	500	861	2.0	11.1	Slightly Sweet	
Silane	SiH_4	5`	7	1.4	96	Choking	
Silicon Tetrachloride	$SiCl_4$	None Established		Nonflammable		Pungent, Suffocating	100
Sulfur Dioxide	SO_2	2.00	5	Nonflammable		Sharp, Pungent	100
Sulfur Hexafluoride	SF_6	1000	5973	Nonflammable		None	
Trichlorosilane	$SiHCl_3$	None Established		1.2	90.5	Pungent, Suffocating	100
Tungsten Hexafluoride	WF_6	None Established		Nonflammable		None	30
Xenon	Xe	Simple Asphyxiant		Nonflammable		None	

Miscellaneous Physical Constants

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Miscellaneous Physical Constants

Numerical Constant	Value	Units
Avogadro's Number	6.022045×10^{23}	Molecules/g-mole
Gas-Law Constant R	1.98719	cal/(g-mole) (°K)
	1.98719	Btu/(lb-mole) (°R)
	82.0568	(cm^3) (atm)/(g-mole) (°K)
	0.0820568	(liter) (atm)/(g-mole) (°K)
	10.7314	(ft^3) (lb)/(in^2) (lb-mole) (°R)
	0.730228	(ft^3) (atm)/(lb-mole) (°R)
	8.314510	(kPa) (L)/(g-mol) (°K)
	8314.5100	(Pa) (L)/(g-mol) (°K)
	0.0831451	(bar) (L)/(g-mol) (°K)

Volume of Ideal Gas

Conditions	Volume, L	Volume, m^3
0 °C, 1 atm.	22.414	0.022414
15 °C, 1 atm.	23.645	0.023645
70 °F, 1 atm.	24.146	0.024146
NTP (U.S.)	70 °F, 1 atm.	
STP (U.S.)	0 °C, 1 atm.	

V	T	n	atm	psi	mm Hg	cm Hg	in Hg	in H_2O	ft H_2O
ft^3	°K	mol	0.00290	0.0426	2.20	0.220	0.0867	1.18	0.0982
		lb-mol	1.31	19.31	999	99.9	39.3	535	44.6
	°R	mol	0.00161	0.02366	1.22	0.122	0.0482	0.655	0.0546
		lb-mol	0.730	10.73	555	55.5	21.8	297	24.8
cm^3	°K	mol	82.05	1,206	62,400	6,240	2,450	33,400	2,780
		lb-mol	37,200	547,000	2.83E+07	2.83E+06	1.11E+06	1.51E+07	1.26E+06
	°R	mol	45.6	670	34,600	3,460	1,360	18,500	1,550
		lb-mol	20,700	304,000	1.57E+07	1.57E+06	619,000	8.41E+06	701,000
L	°K	mol	0.08205	1.206	62.4	6.24	2.45	33.4	2.78
		lb-mol	37.2	547	28,300	2,830	1,113	15,140	1,262
	°R	mol	0.0456	0.670	34.6	3.46	1.36	18.5	1.55
		lb-mol	20.7	304	15,700	1,570	619	8,410	701

This table gives the appropriate value of R for use in the ideal gas equation, PV=nRT, when the variable are expressed in other units.

* Unless otherwise noted mol = g-mol

Physical Properties of Gases

Physical Properties of Gases

Gas			Argon	Carbon Dioxide	Helium	Neon	Nitrogen	Oxygen
Atomic or Molecular Weight			39.948	44.010	4.0026	20.183	28.013	31.999
Normal Boiling Point (nbp)		°F	-302.6	-109.3*	-452.1	-410.9	-320.4	-297.3
Freezing Point		°F	-308.9	-109.3	–	-415.5	-346.0	-361.8
Triple Point (tp)		°F	-308.9	-69.8	–	-415.5	-346.0	-361.8
		psia	10.0	75.2	–	6.3	1.8	0.022
Critical Point		°F	-188.1	87.9	-450.3	-380.0	-232.5	-181.1
		psia	710.0	1071.0	33.2	395.0	493.0	737.0
Density	Gas, NTP	lb/ft^3	0.1034	0.1144	0.01034	0.05215	0.07245	0.08281
	Gas, STP	lb/ft^3	0.1114	0.1234	0.01114	0.05618	0.07805	0.08921
	Vapor, nbp	lb/ft^3	0.363	–	1.04	0.596	0.287	0.279
	Liquid, nbp	lb/ft^3	86.98	63.36**	7.798	75.35	50.46	71.27
Specific Heat, Cp, Gas, NTP Btu/lb °F			0.125	0.20	1.25	0.246	0.247	0.220
Specific Heat Ratio, Cp/Cv, Gas, NTP			1.67	1.31	1.66	1.66	1.41	1.40
Heat of Vaporization, nbp		Btu/lb	70.2	246.6*	8.72	37.0	85.7	91.7
Heat of Fusion, tp		Btu/lb	12.7	85.6	–	7.1	11.1	6.0

* Denotes sublimation temperature at 1 atmosphere.

** Liquid density at 2 °F and 302 psig.

Physical Property Equivalents of Gases

	Mass			Volume			Heat of Vaporization	
Gas	Tons	Pounds	Kilograms	Cubic Feet Gas at NTP	Liters Liquid at nbp	Gallons Liquid at nbp	Btu	Kilogram-Calories
Argon	1	2000	907.2	1.934×10^4	651.1	172.0	1.40×10^5	3.54×10^4
	0.0005	1	0.4536	9.671	0.3256	0.08600	70.2	17.7
	0.0011023	2.205	1	21.32	0.7177	0.1896	155.0	39.0
	5.170×10^{-5}	0.1034	0.04690	1	0.03366	0.008893	7.26	1.83
	0.001536	3.072	1.393	29.71	1	0.2642	216.0	54.3
	0.005814	11.63	5.274	112.5	3.785	1	816.0	206.0
Carbon Dioxide	1	2000	907.2	1.748×10^4	893.8*	236.1*	4.93×10^5	1.24×10^5
	0.0005	1	0.4536	8.74	0.4469*	0.11806*	247.0	62.1
	0.0011023	2.205	1	19.27	0.9854*	0.2603*	544.0	137.0
	5.72×10^{-5}	0.11442	0.05189	1	0.05113*	0.013508*	28.2	7.11
	0.001119	2.238	1.0148	19.558	1*	0.2642*	552.0	139.0
	0.004235	8.471	3.842	74.03	3.785*	1*	2089.0	526.0
Helium	1	2000	907.2	1.934×10^5	7263.0	1919.0	1.74×10^4	4.39×10^3
	0.0005	1	0.4536	96.71	3.631	0.9593	8.72	2.20
	0.0011023	2.205	1	213.2	8.006	2.115	19.2	4.84
	5.170×10^{-6}	0.01034	0.004690	1	0.03755	0.009919	0.0902	0.0227
	1.377×10^{-4}	0.2754	0.1249	26.63	1	0.2642	2.40	0.605
	5.212×10^{-4}	1.042	0.4728	100.8	3.785	1	9.09	2.29
Neon	1	2000	907.2	3.835×10^4	751.6	198.6	7.40×10^4	1.86×10^4
	0.0005	1	0.4536	19.18	0.3758	0.09928	37.0	9.32
	0.0011023	2.205	1	42.27	0.8285	0.2189	81.6	20.6
	2.608×10^{-5}	0.05215	0.02365	1	0.01960	0.005177	1.93	0.486
	0.001330	2.661	1.207	51.03	1	0.2642	98.5	24.8
	0.005036	10.07	4.569	193.2	3.785	1	373.0	93.9
Nitrogen	1	2000	907.2	2.761×10^4	1122.0	296.5	1.71×10^5	4.32×10^4
	0.0005	1	0.4536	13.80	0.5612	0.1482	85.7	21.6
	0.0011023	2.205	1	30.43	1.237	0.3268	189.0	47.6
	3.622×10^{-5}	0.07245	0.03286	1	0.04066	0.01074	6.21	1.56
	8.910×10^{-4}	1.782	0.8083	24.60	1	0.2642	153.0	38.5
	0.003373	6.746	3.060	93.11	3.785	1	578.0	146.0
Oxygen	1	2000	907.2	2.415×10^4	794.6	209.9	1.83×10^5	4.62×10^4
	0.0005	1	0.4536	12.08	0.3973	0.1050	91.7	23.1
	0.0011023	2.205	1	26.62	0.8759	0.2314	202.0	50.9
	4.140×10^{-5}	0.08281	0.03756	1	0.03290	0.008692	7.59	1.91
	0.001258	2.517	1.142	30.39	1	0.2642	231.0	58.2
	0.004764	9.527	4.322	115.1	3.785	1	874.0	220.0

Dew Point

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Dew Point vs. Parts per Million*

* @ 760 Torr

Dewpoint		
°F	°C	ppm
-130	-90.0	0.10
-120	-84.0	0.25
-110	-79.0	0.63
-105	-76.0	1.00
-104	-76.0	1.08
-103	-75.0	1.18
-102	-74.0	1.29
-101	-74.0	1.40
-100	-73.0	1.53
-99	-73.0	1.66
-98	-72.0	1.81
-97	-72.0	1.96
-96	-71.0	2.15
-95	-71.0	2.35
-94	-70.0	2.54
-93	-69.0	2.76
-92	-69.0	3.00
-91	-68.0	3.28
-90	-68.0	3.53
-89	-67.0	3.84
-88	-67.0	4.15
-87	-66.0	4.50
-86	-66.0	4.78
-85	-65.0	5.3
-84	-64.0	5.7
-83	-64.0	6.2
-82	-63.0	6.6
-81	-63.0	7.2
-80	-62.0	7.8
-79	-62.0	8.4
-78	-61.0	9.1
-77	-61.0	9.8
-76	-60.0	10.5
-75	-59.0	11.4
-74	-59.0	12.3

Dewpoint		
°F	°C	ppm
-73	-58.0	13.3
-72	-58.0	14.3
-71	-57.0	15.4
-70	-57.0	16.6
-69	-56.0	17.9
-68	-56.0	19.2
-67	-55.0	20.6
-66	-54.0	22.1
-65	-54.0	23.6
-64	-53.0	25.6
-63	-53.0	27.5
-62	-52.0	29.4
-61	-52.0	31.7
-60	-51.0	34.0
-59	-51.0	36.5
-58	-50.0	39.0
-57	-49.0	41.8
-56	-49.0	44.6
-55	-48.0	48
-54	-48.0	51
-53	-47.0	55
-52	-47.0	59
-51	-46.0	62
-50	-46.0	67
-49	-45.0	72
-48	-44.0	76
-47	-44.0	82
-46	-43.0	87
-45	-42.8	92
-44	-42.2	98
-43	-41.7	105
-42	-41.1	113
-41	-40.6	119
-40	-40.0	128
-39	-39.4	136

Dewpoint		
°F	°C	ppm
-38	-38.9	144
-37	-38.3	153
-36	-37.8	164
-35	-37.2	174
-34	-36.7	185
-33	-36.1	196
-32	-35.6	210
-31	-35.0	222
-30	-34.4	235
-29	-33.9	250
-28	-33.3	265
-27	-32.8	283
-26	-32.2	300
-25	-31.7	317
-24	-31.1	338
-23	-30.6	358
-22	-30.0	378
-21	-29.5	400
-20	-28.9	422
-19	-28.4	448
-18	-27.8	475
-17	-27.2	500
-16	-26.7	530
-15	-26.1	560
-14	-25.6	590
-13	-25.0	630
-12	-24.4	660
-11	-23.9	700
-10	-23.3	740
-9	-22.8	780
-8	-22.2	820
-7	-21.7	870
-6	-21.1	920
-5	-20.6	970
-4	-20.0	1020

CGA Connections

Name	Chemical	CGA Formula	DISS
Acetylene	C_2H_2	510, 300*	
Air	N/A	346, 590*	
Ammonia	NH_3	240/705, 660*	720
Argon	Ar	580	718
Boron trichloride	BCl_3	660	634
Boron trifluoride	BF_3	330	642
Butadiene, 1,3-	CH_2:CHCH:CH_2	510	
Butane, n-	C_4H_{10}	510	
Butene, 1-	CH_3CH_2CH:CH_2	510	
Carbon Dioxide	CO_2	320	716
Carbon Monoxide	CO	350	724
Chlorine	Cl_2	660	728
Deuterium	D_2	350	724
Dichlorosilane	SiH_2Cl_2	678	636
Ethane	C_2H_6	350	724
Ethylene	CH_2:CH_2	350	724
Halocarbon-14	CF_4	580, 320*	716
Halocarbon-22	$CHClF_2$	660	
Halocarbon-23	CHF_3	660	716
Halocarbon-116	C_2F_6	660, 320*	716
Halocarbon-134A	CF_3CH_2F	165, 660*	716
Halocarbon-218	C_3F_8	660	716
Halocarbon-C318	C_4F_8	660	716
Helium	He	580	718
Hydrogen	H_2	350	724
Hydrogen Bromide	HBr	330	634
Hydrogen Chloride	HCl	330	634
Hydrogen Sulfide	H_2S	330	722

* Limited Standard

Name	Chemical Formula	CGA	DISS
Isobutane	$CH(CH_3)_3$	510	
Isobutylene	$(CH_3)_2C$:CH_2	510	
Krypton	Kr	580	718
Methane	CH_4	350	
Methyl Chloride	CH_3Cl	510, 660*	
Neon	Ne	580	718
Nitric Oxide	NO	660	
Nitrogen	N_2	580	718
Nitrogen Dioxide	NO_2	660	
Nitrogen Trifluoride	NF_3	670, 330*	640
Nitrous Oxide	N_2O	326	712
Oxygen	O_2	540	714
Phosphine	PH_3	350, 660*	632
Propane	C_3H_8	510, 660*	
Propylene	CH_2:$CHCH_3$	510, 660*	
Silane	SiH_4	350	632
Silicon Tetrachloride	$SiCl_4$		
Sulfur Dioxide	SO_2	660	
Sulfur Hexafluoride	SF_6	590	716
Trichlorosilane	$SiHCl_3$		636
Tungsten Hexafluoride	WF_6	670	638
Xenon	Xe	580	718

* Limited Standard

Abbreviations and Symbols

PRAXAIR
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Symbol	Definition
A	
Å	Angstrom(s)
AA	Atomic Absorption
abs	absolute
ACGIH	American Conference of Governmental Industrial Hygienists
ASTM	American Society for Testing Materials
atm	atmosphere(s)
avg	average
B	
BAR	Bureau of Automotive Repair
bar	Unit of pressure equal to 100,000 pascals
bp	boiling point
BTU	British thermal unit(s)
C	
CAA	Clean Air Act
cal	calorie(s)
CAS	Chemical Abstract Services
ccm	cubic centimeter(s) per minute
ccs	cubic centimeter(s) per second
CEM	Continuous Emission Monitor
cf	cubic feet
CFCs	Chlorofluorocarbons
CFR	Code of Federal Regulations
CGA	Compressed Gas Association
cm	centimeter(s)
cm^2	square centimeter
cm^3, cc	cubic centimeter
COA	Certificate of Analysis
COC	Certificate of Conformance
CP	Chemically Pure
Cp	specific heat at constant pressure
Cv	specific heat at constant volume
Cv	coefficient of flow
°C	degree(s) Celsius

Symbol	Definition
D	
DID	Discharge Ionization Detector
DIN	Deutsche Industrie Normen (German Industrial Standards)
DISS	Diameter Index Safety System
DOT	Department of Transportation
E	
ea	each
ECD	Electron Capture Detector
EPA	Environmental Protection Agency
F	
FID	Flame Ionization Detector
FNPT	Female National Pipe Thread
F.O.B.	Freight on Board
FPD	Flame Photometric Detector
FPT	Female Pipe Thread
ft	foot, feet
ft^3, cu ft	cubic foot (feet)
FTIR	Fourier Transform Infrared Spectrometer or Spectroscopy
FIFRA	Federal Insecticide, Fungicide, and Rodenticide Act
°F	degree(s) Fahrenheit
G	
g	gram(s)
gal	gallon(s)
GC	Gas Chromatography or Chromatograph
GMIS	Gas Manufacturers Intermediate Standard
GMP	Good Manufacturing Practice(s)
GPA	Gas Processors Association
H	
Hall	Electrolytic Conductivity Detector
HAP	Hazardous Air Pollutants
HID	Helium Ionization Detector
hr	hour
Hz	hertz

Symbol	Definition
I	
ICP	Inductively Coupled Plasma (Spectroscopy)
ID	identification or inside diameter
IDLH	Immediately Dangerous to Life or Health
in	inch
in^3, cu in	cubic inch(es)
ISO	International Organization for Standardization
J	
J	joule
K	
K	Kelvin
kg	kilogram(s)
kPa	Kilopascal(s)
°K	degree(s) Kelvin
L	
L	liter(s)
lb	pound(s)
LC	Liquid Chromatography
LEL	Lower Explosive Limit
Lpm	liters per minute
M	
µ	micron(s), 10^{-6} m
m^3	cubic meter(s)
mA	milliampere
max	maximum
mg	milligram(s)
min	minute(s)
ml	milliliter(s)
mm	millimeter(s)
MNPT	Male National Pipe Thread
mol.wt.	molecular weight
MOS	Metal Oxide Semiconductor
MPT	Male Pipe Thread
mp	melting point
MS	Mass Spectrometry
MTBE	Methyl Tertiary Butyl Ether
MVCR	Male VCR
MVFS	Male Vacuum Face Seal
MW	molecular weight

Abbreviations and Symbols

Symbol	Definition
N	
N/A	Not Applicable
nbp	normal boiling point
NDIR	Non–Dispersive Infrared Analyzer
NDUV	Non–Dispersive Ultraviolet Analyzer
NER	normal evaporation rate
NF	National Formulary
NFPA	National Fire Protection Association
NIOSH	National Institute for Occupational Safety and Health
NIST	National Institute of Standards and Technology
nm	nanometer(s)
NMR	Nuclear Magnetic Resonance Spectroscopy
No	number
nom	nominal
NOS	Not Otherwise Specified
NPD	Nitrogen/Phosphorous Detector
NPT	National Pipe Thread
NTP	Normal Temperature and Pressure
NTRM	NIST Traceable Reference Material
O	
OD	Outside Diameter
Ohm–cm	ohms centimeter
OSHA	Occupational Safety and Health Administration
oz	ounce(s)
P	
Pa	Pascal(s)
PAMS	Photochemical Air Monitoring Systems
PID	Photo Ionization Detector
ppb	part(s) per billion
ppba	part(s) per billion atomic
ppbv	part(s) per billion by volume
ppbw	part(s) per billion by weight
ppm	part(s) per million

Symbol	Definition
P continued	
ppma	part(s) per million atomic
ppmv	part(s) per million by volume
ppmw	part(s) per million by weight
ppt	part(s) per trillion
ppta	part(s) per trillion atomic
pptv	part(s) per trillion by volume
pptw	part(s) per trillion by weight
psi	pound(s) – force per square inch
psia	pound(s) – force per square inch absolute
psig	pound(s) – force per square inch gauge
Q	
QA	Quality Assurance
QC	Quality Control
R	
Ra	Roughness average
RFO	Restricted Flow Orifice
°R	degree(s) Rankine
S	
scc	standard cubic centimeters
sccm	standard cubic centimeters per minute
sccs	standard cubic centimeters per second
scfh	standard cubic feet per hour
scfm	standard cubic feet per minute
scfs	standard cubic feet per second
SDS	Safety Data Sheet
sec	second(s)
SFC	Supercritical Fluid Chromatography
SFE	Supercritical Fluid Extraction
slpm	standard liters per minute
sp. gr.	specific gravity
sp. vol.	specific volume
SRM	Standard Reference Materials
SS	Stainless Steel
Stn. Stl.	Stainless Steel
STEL	Short Term Exposure Limit
STP	Standard Temperature and Pressure

Symbol	Definition
T	
TCD	Thermal Conductivity Detector
TEA	Transversely Excited Atmosphere
THC	Total Hydrocarbon Content
TLV	Threshold Limit Value
tp	triple point
TPH	Total Petroleum Hydrocarbons
TWA	Time Weighted Average
U	
UEL	Upper Explosive Limiit
UHP	Ultra High Purity
UN	United Nations
USP	United States Pharmacopoeia
V	
VAC	Volts Alternating Current
VDC	Volts Direct Current
VOC	Volatile Organic Compounds
vol	volume
vol%	volume percent
W	
w.c.	water column pressure
wt.	weight
wt%	weight percent
wt. ppm	weight parts per million
Y	
yd	yard(s)
>	Greater than
≥	Greater than or equal
<	Less than
≤	Less than or equal

Glossary

Absolute Pressure – A quantity of pressure measured with respect to total vacuum. Equal to the sum of a pressure gauge reading and atmospheric pressure.

Absolute Zero – The minimum point in thermodynamic temperature scale (-273.1 6 °C or -459.69 °F)

Absorption – The penetration of matter in bulk into other matter, as in the dissolving of a gas in liquid.

Accuracy – The degree of agreement of a measured value with the true or expected value of the quantity of concern.

Adsorption – Adherence of the atoms, ions or molecules of a gas or liquid to the surface of another substance, called the adsorbent. Molecular Sieves are adsorbents.

American Conference of Governmental Industrial Hygienists (ACGIH) – This Conference is a professional society, not an official Government Agency. It is an organization devoted to the development of administrative and technical aspects of worker protection.

Anhydrous – A descriptive term meaning without water.

Annealing Gas – A hydrogen and nitrogen mixture used to provide a reducing atmosphere during heating of metals to render them less brittle on cooling.

Asphyxiant Gas – A gas which has little or no positive toxic effect but which can bring about unconsciousness and death by replacing air and thus depriving an organism of oxygen.

Attached Poppett (Tied-Seat; Tied-Diaphragm) – A feature of certain regulators whereby the stem (poppet) is physically attached to the diaphragm.

Atomic Weight – The relative weight of an atom of an element, compared to carbon-12. Equivalent to the sum of protons and neutrons in the nucleus.

Azeotropic Mixture (Azeotrope) – A liquid mixture of two or more substances which behaves like a single substance in that the vapor produced by partial evaporation of liquid has the same composition as the liquid. The constant boiling mixture exhibits either a maximum or minimum boiling point as compared with that of other mixtures of the same substances.

Back Pressure Regulator – A pressure regulator which controls upstream (inlet) pressure. Similar in function to a relief valve.

Balanced Poppet (Balanced Valve; Balanced Stem) – A valve which has been designed to be pressure balanced; hence the valve spring provides the shutoff force. Used essentially to reduce or minimize decaying inlet pressure effect.

Boiling Point – The temperature at which the vapor pressure of the liquid is equal to the prevailing pressure of the atmosphere. The normal boiling point is the temperature at which the vapor pressure of the liquid is 14.7 psia (1 atm).

Bonnet (Spring Housing) – The part of a regulator which houses the control spring.

Bourdon Tube – A curved metal tube, sealed at one end, which flexes to a known degree when pressurized internally.

Brass – Copper/zinc alloys of varying composition. Some brass also contains low percentages of other elements such as manganese, aluminum, silicon, lead and tin.

British Thermal Unit (BTU) – The quantity of heat required to raise the temperature of one pound of water one degree F at or near its point of maximum density (39.1°F).

Bursting Disk (Frangible Disk) – A metal disk which is part of a safety device, and which is intended to burst and allow gas to escape within predetermined pressure limits to prevent rupture of the device it is installed on. Similar in function to a safety relief valve, except it has no reseal capability.

Burst Pressure – A design test pressure which allows for permanent deformation and leakage, but parts must remain assembled (i.e., no sudden ruptures). Normal industry standard is 4 times (400%) of maximum oper-ating pressure. See also **"Proof Pressure"** and **"Maximum Operating Pressure."**

Calibration – Comparison of a measurement standard or instrument with another standard or instrument to report or eliminate by adjustment any variation (deviation) in the accuracy of the item being compared.

Calibration Gas – A gas or gas mixture of accurately known composition used as a comparative standard in analytical instrumentation.

Calorie – The amount of heat required to raise the temperature of one gram of water one degree Celsius.

Carrier Gas – Gas used with a gas chromatography to carry the sample through the system.

Catalyst – A substance that initiates a chemical reaction and allows it to proceed under different conditions than otherwise possible.

CGA Number – Cylinder/container valve outlet connection number assigned by the Compressed Gas Association. CGA numbers are detailed in CGA Standard V-1.

Chemical Abstract Services (CAS) – CAS numbers represent chemical substances recorded in the CAS Chemical Registry System. This numbering system identifies chemical substances by an unambiguous computer language description of its molecular structure, including all stereo-chemical detail. The CAS number, which has no chemical significance, is simply a number assigned in sequential order to each substance as it enters the Registry System. All specific substances reported in the worldís scientific and technical literature and indexed in Chemical Abstracts, (CA) since 1965 (when the Registry System began) are included in this master file.

Chemiluminescence – A species which chemically absorbs and emits light (usually at low temperatures).

Chromatogram – The record produced by the gas liquid chromatograph. It is also a measure of instrument performance.

Coefficient of Flow (Cv) – Defined as the actual flow performance in U.S. gallons of water per minute at 60 °F when inlet pressure (P1) is 1 psig and outlet pressure (P2) is atmospheric (14.7 psia).

Column – Part of the gas chromatography system where the separation of the sample takes place (can be packed or capillary).

Combustion – An exothermic oxidation reaction which may occur with any organic compound, as well as with certain elements.

Compressed Gas – (1) A gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70 °F; or **(2)** a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130 °F regardless of the pressure at 70 °F or **(3)** a liquid flammable material having a vapor pressure exceeding 40 psi at 100 °F as determined by ASTM D-323-72.

Compressed Gas Association (CGA) – This is a nonprofit technical association whose membership includes many corporations active in all phases of the compressed gas industries. Founded in 1913, the CGA uses experience and knowledge of its members to promote industry wide standards and procedures for safety in the manufacture, storage, transport and use of compressed gases.

Corrosive – The ability of a chemical compound to attack and produce irreversible damage to human tissues, such as eyes, skin or mucous membranes. Also, the ability of a chemical compound to attack and eat away rubber, metal and other substances.

Cracking Pressure – A term used in back pressure control only (e.g., back pressure regulators, relief valves), for determining the inlet pressure at which flow starts.

Creep – Any increase in outlet pressure of a pressure regulator subsequent to lockup. Usually seen as a long term slow pressure increase. This generally indicates a seat leak which is an abnormal condition.

Critical Density – The density of a pure material at its critical temperature and critical pressure.

Critical Point – The transition point at which the liquid and gaseous states of a substance merge into each other. It is the temperature above which a substance cannot exist in two phases, no matter how great the pressure. See also **"Critical Temperature"** and **"Critical Pressure."**

Critical Pressure – At the critical temperature, the highest pressure at which a pure material can exist as a gas in equilibrium with its liquid.

Critical Temperature – The temperature above which a gas cannot be liquefied by pressure alone. At this temperature, there is no distinction between liquid and vapor, both having the same density and constituting one homogenous system.

Cryogenic Liquid – A liquid having a normal boiling point below -240 °F (-151.11 °C).

Cryogenic Liquid Container – An insulated container designed to store, handle and transport liquids having boiling points below -130 °F.

Cylinder – A container designed to hold compressed gases or liquefied compressed gases. Cylinders are manufactured and tested according to DOT/TC/MEX specifications.

Dehydration – Removal of one or more molecules of water from a chemical compound.

Delayed (Chronic) Health Hazard – See **"EPA Hazard Categories."**

Delivery Pressure – See **"Outlet Pressure."**

Density – The ratio of the amount of anything per unit volume; e.g., mass of any substance per unit volume at any definite temperature. It is usually expressed in pounds per cubic foot (lbs/ft^3). See also **"Specific Gravity."**

Department of Transportation (DOT) – This is a federal agency whose Title 49, Code of Federal Regulations regulates the transport of hazardous materials.

Glossary

Dewar – Vessel which contains cryogenic liquefied gases.

Dew Point – The temperature at which the liquefaction of vapor begins; the term is usually applied to condensation of moisture from the water vapor in the atmosphere.

Diameter Index Safety System (DISS) – DISS outlet valves are generally used with high-purity products, toxics, and corrosives. Valves equipped with DISS outlet assignment provide a metal-to-metal seal that creates low particle generation, a permeation-free environment, and good leak integrity.

Dopant – An impurity usually added in small amounts to a pure substance to alter its properties.

DOT ID Numbers –
These are product identification numbers, assigned by the Department of Transportation (DOT) to assist members of fire and police departments in using the DOT Emergency Response Guidebook. DOT ID numbers contain two letters followed by four digits. The prefix UN (for United Nations) identifies products recognized throughout the world. Gaseous nitrogen, for example, is identified as UN 1066.

Droop – The decrease in outlet set pressure of a pressure regulator which results from an increase in flow rate. Essentially the reverse of lockup. See also **"Lockup."**

Eductor (Liquid Delivery) Tube – A tube inside a cylinder or container attached to the cylinder valve which allows liquid product withdrawal from the cylinder.

Effluent Splitter – The part of the analytical instrument that splits the effluent stream into multiple detectors or some to vent for a lower volume of effluent.

Environmental Protection Agency (EPA) – This is a federal agency that establishes environmental standards within the United States.

EPA Hazard Categories – The hazard categories used throughout this catalog as defined under EPA SARA Title III and 1910.1200 of Title 29 of the Code of Federal Regulations are as follows:

- "Immediate (Acute) Health Hazard" including highly toxic, corrosive, toxic, irritant, sensitizer, and other hazardous chemicals which cause an adverse effect to a target organ which manifests itself within a short period of time following a one-time, high exposure to the substance.
- "Delayed (Chronic) Health Hazard" including carcinogens and other hazardous chemicals which cause an adverse effect to a target organ which manifests itself after a long period of time following or during repeated contacts with the substance.
- "Fire Hazard" including flammable, combustible pyrophoric, and oxidizer.
- "Sudden Release of Pressure Hazard including explosive and compressed gas.
- "Reactive Hazard" including unstable reactive, organic peroxide, and water reactive.

Exposure Limits – Concentrations of substances (and conditions) under which it is believed that nearly all workers may be repeatedly exposed day after day without adverse effects. ACGIH limits are called TLV and OSHA exposure limits are called PEL. See **"Threshold Limit Value."**

Filling Density – The percent ratio of the weight of gas in a container to the weight of water that the container will hold at 60 °F.

Fire Hazard –
See **"EPA Hazard Categories."**

Flammable Gas – (1) A gas that, at ambient temperature and pressure, forms a flammable mixture with air at a concentration of 13% by volume or less; or (2) a gas that, at ambient temperature and pressure, forms a range of flammable mixtures with air wider than 12% by volume regardless of the lower limit.

Flammable Limits – The concentration of flammable vapor in air, oxygen, or other oxidant that will propagate flame upon contact when provided with a source of ignition. The lower explosive limit (LEL) is the concentration below which a flame will not propagate; the upper explosive limit (UEL) is the concentration above which a flame will not propagate. A change in temperature or pressure may vary the flammable limits.

Flammable Range – The range over which a gas at NTP will form a flammable mixture with air.

Flash Point – The lowest temperature at which a flammable liquid will give off enough vapor at or near its surface to form an ignitable mixture with air.

Flow Capacity – The maximum flow capability of a control device established at a specific set of conditions.

Fluid – Any material or substance that changes shape uniformly in response to an external force imposed upon it. The term applies to liquids, gases and finely divided solids.

Freezing Point – The temperature at which a liquid solidifies. It is the temperature at which the liquid and solid states of a substance are in equilibrium at a given pressure (usually atmospheric). For pure substances, it is identical with the melting point of the solid form.

Gross Weight – The weight of a package plus the weight of its contents.

Halocarbons – Any hydrocarbon combined with any of the five (F2, Cl2, Br, I, At) elements in the V11A group of the periodic table.

Heat of Adsorption – The total heat involved in the adsorption process from zero adsorbate loading to some final adsorbate loading at a constant temperature (also called isothermal integral heat of adsorption).

Heat of Fusion – The heat energy required to transform one mole of substance from the liquid phase to the vapor phase at one atmosphere of pressure.

Heat of Vaporization – Heat required to convert a substance from the liquid to the gaseous state with no temperature change.

Hydrocarbon – An organic compound containing carbon and hydrogen.

Immediate (Acute) Health Hazard –

See **"EPA Hazard Categories."**

Inert – A material which, under normal temperatures and pressures, does not react with other materials.

Inhibitor – A compound (usually organic) that retards or stops an undesired chemical reaction such as corrosion, oxidation or polymerization.

Inlet Pressure (P_1; Supply Pressure; Upstream Pressure) – The pressure of the fluid to the supply connection of a control device.

Inorganic Substance – Substances that do not contain carbon in their chemical structure.

Irritant – The ability of a chemical, which is not corrosive, to cause a reversible inflammatory effect on living tissue by chemical action at the site of contact.

Isotopes – Forms of an element that differ from one another in the mass of their atoms and in the properties dependent on that mass. Having the same atomic number and the same number of valence electrons, isotopes occupy the same position in the periodic table and have identical properties. They are distinguishable only by the small differences in atomic weight or by radioactive transformations.

Kelvin (K) – A unit of temperature related to the triple point of water.

Liquified Compressed Gas – A gas which, under the charged pressure, is partially liquid at a temperature of 70 °F (21.1 °C).

Liquid Density – The ratio of the mass of a liquid per unit volume at any definite temperature. It is usually expressed in pounds per gallon or pounds per cubic foot.

Lockup – The increase in outlet pressure of a pressure regulator that occurs when flow is stopped. Essentially the reverse of droop.

Lower Explosive Limit (LEL) – The minimum percent by volume of a gas which, when mixed with air at normal temperature and pressure, will form a flammable mixture.
See **"Flammable Gas."**

Manifold – A series of connectors to a common outlet allowing several cylinders to be used simultaneously.

Maximum Operating Pressure –
The maximum allowable use pressure for which a system is designed. Also referred to as "working pressure."

Melting Point – The temperature at which the solid and liquid phase of a substance are in equilibrium (normally specified at one atm).

Micron – One millionth of a meter.

Mixture – Any combination of two or more chemicals if the combination is not, in whole or in part, the result of a chemical reaction.

Mole – The weight of a substance equal numerically to its molecular weight. A gram-mole is the weight in grams equal to the molecular weight; a pound-mole is the weight in pounds equal to the molecular weight.

Molecular Weight – The sum of the atomic weights of all the constituent atoms in the molecule of an element or a compound.

Nanogram (ng) – One billionth of a gram (10^{-9}).

Nanometer (nm) – One billionth of a meter (10^{-9}).

National Formulary (NF) – A supplement to the United States Pharmacopoeia.

Normal Boiling Point (nbp) – The temperature at which the vapor pressure of a liquid reaches 760 mm of mercury.

Normal Evaporation Rate (NER) – The degree of product loss from a cryogenic liquid container due to heat leak into the container as designed. The NER is checked by measuring the amount of product loss over a specified time and serves to confirm whether the insulation is still good or not.

Glossary

Normal Temperature and Pressure (NTP) – A gas industry reference base. Normal temperature is 70 °F. Normal pressure is one atmosphere or 14,696 psia.

Occupational Safety and Health Administration (OSHA) – An organization within the U.S. Department of Labor which sets standards for employers to ensure safe and healthful working conditions for employees.

Outlet Pressure (P_2; Delivery Pressure; Downstream Pressure) – The pressure of the fluid from the discharge connection of a control device.

Oxidizer – A chemical reagent which causes oxidation of other substances and is thereby reduced.

Partial Pressure – In any gas mixture the total pressure is equal to the sum of the pressures (partial) which each gas would exert were it alone in the volume occupied by the mixture.

Parts Per Million (PPM) – A convenient means for expressing low concentrations. As applied to gases, ppm stands for moles per million moles. PPM by weight is expressed as pounds per million pounds. PPM by volume is usually expressed in cubic feet per million cubic feet.

Permissible Exposure Limits (PEL) – See **"Exposure Limit."**

Physical Hazard – Descriptive of a chemical for which there is scientifically valid evidence that it is a combustible liquid, a compressed gas, explosive, flammable, an organic peroxide, an oxidizer, pyrophoric, unstable reactive or water reactive.

Poison – A substance that in relatively small doses has an action, when it is ingested by, injected into, inhaled or absorbed by, or applied to a living organism, that either destroys life or impairs seriously the function of one or more organs or tissues.

Polymerization – A chemical reaction, usually carried out with a catalyst, heat or light, and often under high pressure, in which a large number of relatively simple molecules combine to form a chain-like macromolecule.

Proof Pressure – A test pressure applied to control devices to verify structural integrity. No deformation or excessive leakage is permitted at this pressure and the control device must function normally subsequent to this test. Normal industry standard is 1.5 times (150%) of working pressure. See also **"Burst Pressure"** and **"Maximum Operating Pressure."**

Pyrophoric – The ability of a chemical to ignite spontaneously in air at a temperature of 130 °F or below.

Pyrophoric Gas – A gas that can spontaneously self-ignite when exposed to normal atmospheric conditions.

Rare Gas – Refers to those constituents of air which comprise less than 1% of air and are generally considered inert such as argon, helium, krypton, neon and xenon.

Reactive Hazard – See **"EPA Hazard Categories."**

Relief Valve – A type of pressure relief device which is designed to relieve excessive pressure, and to reclose and reseal to prevent further flow of gas from the cylinder after reseating pressure has been achieved.

Restrictive Flow Orifice (RFO) – A safety device place in the outlet of a cylinder valve that is intended to limit the release rate of a hazardous gas to a maximum specified range in the event of the inadvertent opening of the valve or failure of the system downstream of the valve outlet.

Safety Data Sheet (SDS) – An SDS is a substance fact sheet containing characteristics and hazards of specific hazarous industrial material. Also, these data sheets provide precautionary information on safe handling of the material as well as emergency and first aid procedures.

Safety Relief Device – A safety device usually incorporated in a cylinder valve and actuated by excessive pressure or temperature, or both, at predetermined limits to avoid failure of the pressure vessel.

Self-Relieving (Self-Venting) – A feature incorporated in certain pressure reducing regulators which enables the unit to relieve the outlet pressure when adjusted in the decrease direction.

Sensitizer – The ability of a chemical to cause a substantial proportion of exposed people or animals to develop an allergic reaction in normal tissue after repeated exposure to the chemical.

Short Term Exposure Limit (STEL) – See **"Threshold Limit Value – Short Term Exposure Limit."**

SKIN – The "SKIN" designation, used with the terms TLV-TWA and OSHA-PEL, indicates that cutaneous absorption may contribute to the overall exposure.

Solvent – A substance capable of dissolving another substance (solute) to form a uniformly dispersed mixture (solution) at the molecular or ionic size level.

Span Gas – Gases which are used as a reference point to span an analyzer.

Specific Gravity (Sp. Gr.) – The ratio of the weight of one substance compared to the weight of an equal volume of another substance which is used as a standard. Usually gases are compared to air (air = 1) while liquids and solids are compared to water (H_2O = 1).

Specific Heat – Amount of heat required to raise a unit mass of a substance one degree of temperature at either constant pressure (Cp) or constant volume (Cv).

Specific Heat Ratio – The ratio of specific heat at constant pressure (Cp) to the specific heat at constant volume (Cv).

Specific Volume (Sp. Vol.) – Volume occupied by a unit mass of a substance at a given temperature. It is usually expressed in cubic feet per pound or gallons per pound.

Spring Housing – See **"Bonnet."**

Stainless Steel – Alloy steels containing high percentages of chromium, from less than 10% to more than 25%.

Standard Temperature and Pressure (STP) – An internationally accepted reference base. Standard temperature is OOC. Standard pressure is one atmosphere or 14.6960 psia.

Sublimation – The direct passage of a substance from solid to vapor without appearing in the intermediate (liquid) state. An example is solid carbon dioxide (dry ice) which vaporizes at room temperature.

Sudden Release of Pressure Hazard – See **"EPA Hazard Categories."**

Tare Weight – The weight of an empty cylinder without cap and valve.

Threshold Limit Value (TLV) – TLV's are measures of toxicity established by ACGIH. The TLV of a substance refers, in general, to airborne concentrations at or below which nearly all workers may be repeatedly exposed without adverse effect.

Threshold Limit Value – Ceiling (TLV-Ceiling) – Refers to an airborne concentration that should not be exceeded even instantaneously.

Threshold Limit Value – Short Term Exposure Limit (TLV-STEL) – Refers to a 15 minute time-weighted average exposure which should not be exceeded at any time during a workday even if the time-weighted average is within the TLV. It supplements the 8 hour TLV-TWA for certain substances that produce acute effects on high, short term exposure.

Threshold Limit Value – Time Weighted Average (TLV-TWA) – Refers to the time-weighted average concentration for a normal 8 hour work-day and a 40 hour workweek to which nearly all workers may be repeatedly exposed, day after day, without adverse effect.

Tied-Diaphragm – See "Attached Poppet."

Tied-Seat – See "Attached Poppet."

Total Hydrocarbon Content (THC) – THC is used to describe the quantity of the hydrocarbon impurities present. Usually expressed as methane equivalents.

Toxic – A substance that has the ability to produce injurious or lethal effects through its chemical interaction with the body.

Triple Point (tp) – The definite temperature and pressure for a pure substance at which the three phases (solid, liquid and vapor) coexist in equilibrium as an invariant system.

United Nations (UN) – See **"DOT" ID Numbers.**

United States Pharmacopoeia (USP) – The official publication for drug product standards.

Unstable Reactive – The ability of a chemical in the pure state, or as produced or transported, to vigorously polymerize, decompose, condense, or become self-reactive under conditions of shock, pressure or temperature.

Upstream Pressure – See **"Inlet Pressure."**

Vapor Pressure – The pressure characteristic at any given temperature of a vapor in equilibrium with its liquid or solid form.

Water Reactive – The ability of a chemical to react with water to release a gas that is either flammable or presents a health hazard.

Working Pressure – See **"Maximum Operating Pressure."**

Zero Gas – Gases which are used as a reference point to "zero" an analyzer.