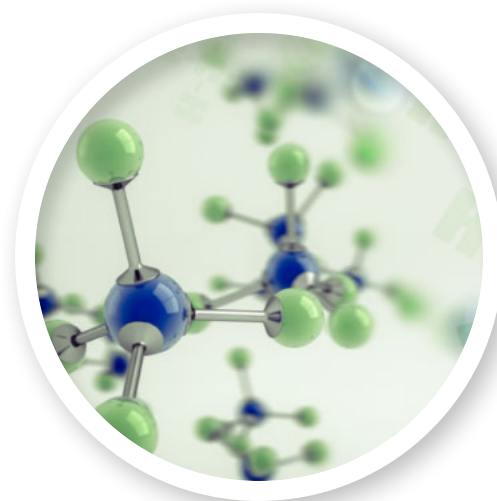




# Stable Isotope-Labeled Gases

Please inquire if an alternate gas, label, or mix is required.



## Packaging Options Included

Cambridge Isotope Laboratories, Inc. is pleased to offer a wide variety of gases enriched with  $^{12}\text{C}$ ,  $^{13}\text{C}$ ,  $\text{D}$ ,  $^{15}\text{N}$ , and/or  $^{18}\text{O}$ . Some of the many applications for these stable isotope gases include breath test analysis, microelectronics, organic light-emitting diodes (OLEDs), nitrogen fixation, quantum computing, and *in vivo* labeling of plants.

Note: the gas and necessary cylinder or breakseal (BS) flask are typically sold separately (see packaging options section), while some gases are available for refill.

### Compounds

Compounds and Mixes (unlabeled CAS No.)	Catalog No.	Label and Enrichment	Unit	Typical Packaging
1-Butene (106-98-9)	CLM-3505	1- $^{13}\text{C}$ , 99%	Please inquire	CODE K
	CLM-4309	1,2- $^{13}\text{C}_2$ , 99%	Please inquire	Please inquire
	DLM-4623	4,4,4- $\text{D}_3$ , 98%	Please inquire	Please inquire
Ammonia (7664-41-7)	NLM-107	$^{15}\text{N}$ , 98%	0.1 or 1 L	CODE M or BS
	NLM-107-10	$^{15}\text{N}$ , 10%	10 L	CODE M
	DLM-389	$\text{D}_3$ , 99%	5, 10, 25, or 50 L	CODE K or M
	NDLM-860	$^{15}\text{N}$ , 98%; $\text{D}_3$ , 98%	0.5 or 1 L	CODE M or BS
Argon (7440-37-1)	ARLM-6672	$^{36}\text{Ar}$ , 99.5%	Please inquire	Please inquire
Bromomethane (74-83-9)	CLM-1217	$^{13}\text{C}$ , 99%	1 or 5 L	CODE K or M, or BS
	DLM-401	$\text{D}_3$ , 99%	5 g	CODE K
1,3- Butadiene (106-99-0)	CLM-7114	$^{13}\text{C}_4$ , 99% (+ hydroquinone stabilizer)	Please inquire	Please inquire
	DLM-877	1,1,4,4- $\text{D}_4$ , 98% (+ hydroquinone stabilizer)	1 L	Please inquire
	DLM-876	$\text{D}_6$ , 98% (+ hydroquinone stabilizer)	1 L	CODE K or BS
N-Butane (106-97-8)	CLM-8994	1- $^{13}\text{C}$ , 99%	Please inquire	CODE K
	DLM-1610	$\text{D}_{10}$ , 98%	1 L	CODE C or BS
Carbon dioxide (124-38-9)	CLM-880	$^{12}\text{C}$ , 99.95%	5 L	CODE C
	CLM-477	$^{12}\text{C}$ , 99.99%	5 or 25 L	CODE C
	CLM-185	$^{13}\text{C}$ , 99% (<2% $^{18}\text{O}$ )	1 or 5 L	CODE C or BS
	OLM-186	$^{18}\text{O}_2$ , 95%	Please inquire	Please inquire
Carbon monoxide (630-08-0)	CLM-424	$^{12}\text{C}$ , 99.99%	5 or 25 L	CODE C or H
	CLM-189	$^{13}\text{C}$ , 99% (<5% $^{18}\text{O}$ )	0.25, 1, or 5 L	CODE C or BS
	COLM-885	$^{13}\text{C}$ , 99%; $^{18}\text{O}$ , 95%	Please inquire	Please inquire
	OLM-190	$^{18}\text{O}$ , 95%	Please inquire	Please inquire
	HPG-030	CP 99.9%	Please inquire	Please inquire
	HPG-035	CP 99.95%	Please inquire	Please inquire
	HPG-040	CP 99.99%	Please inquire	Please inquire
HPG-045	CP 99.995%	Please inquire	Please inquire	

Chemical purity (CP) is 98% or greater, unless otherwise indicated.

Continued ►

Cambridge Isotope Laboratories, Inc.

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## Compounds (continued)

Compounds and Mixes (unlabeled CAS No.)	Catalog No.	Label and Enrichment	Unit	Typical Packaging
Carbonyl sulfide (463-58-1)	CLM-4619	<sup>13</sup> C, 99%	Please inquire	Please inquire
Chloroethane (75-00-3)	DLM-2809	2-D, 98%	Please inquire	Please inquire
	DLM-1612	2,2,2-D <sub>3</sub> , 98%	Please inquire	Please inquire
	DLM-1171	D <sub>5</sub> , 98%	5 g	CODE C
Chloromethane (74-87-3)	CLM-339	<sup>13</sup> C, 99%	1 L	CODE C or BS
	DLM-337	D <sub>3</sub> , 99%	1 L	CODE M or BS
Cyclotron Target Gas Mixture 39 (7727-37-9 for N2)	CGM-P39	<sup>15</sup> N <sub>2</sub> , 99%: 1 O <sub>2</sub> (CP 99.99%)	26 L	CODE I
Deuterium (1333-74-0)	DLM-408	D, 99.8% (D <sub>2</sub> , 99.6% + HD, 0.4%)	25, 50, 100, 250, 500, 850, or 1000 L	CODE C, H, or L
	DLM-408-4NHP	D, 99.8% (CP 99.99%)	Please inquire	CODE C, H, or L
	DLM-408-HP	D, 99.8% (CP 99.999%)	Please inquire	CODE C, H, or L
	DLM-1329	D, 99.9% (D <sub>2</sub> , 99.8% + HD, 0.2%)	25, 50, or 850 L	CODE C or H
	DLM-1003	D, 99.96% (<400 ppm HD)	Please inquire	Please inquire
Deuterium bromide (10035-10-6)	DLM-342	D, 99%	5 or 25 L	CODE K
Deuterium chloride (7647-01-0)	DLM-458	D, 99%	5 L	CODE K
Deuterium hydride (1333-74-0)	DLM-194	D, 97%	1, 5, 10, or 30 L	CODE K or U
Deuterium iodide (10034-85-2)	DLM-596	D, 98%	1 or 5 L	CODE K
Deuterium sulfide (7783-06-4)	DLM-791	D <sub>2</sub> , 98%	5 L	CODE K
Dichlorofluoromethane (75-43-4)	DLM-1558	D, 98% (CP 96%)	Please inquire	CODE K
Difluoromethane (75-10-5)	CLM-1604	<sup>13</sup> C, 99%	Please inquire	Please inquire
	DLM-1614	D <sub>2</sub> , 98%	Please inquire	Please inquire
	CDLM-6057	<sup>13</sup> C, 99%; D <sub>2</sub> , 98%	Please inquire	Please inquire
Dimethyl ether (115-10-6)	CLM-1517	<sup>13</sup> C <sub>2</sub> , 99% (CP 95%)	Please inquire	CODE K
	DLM-340	D <sub>6</sub> , 99%	Please inquire	Please inquire
Dimethylamine (124-40-3)	DLM-267	D <sub>6</sub> , 99%	5 g	CODE K
Ethane (74-84-0)	CLM-2187	1- <sup>13</sup> C, 99%	0.25 L	BS
	DLM-9183	1,1,1-D <sub>3</sub> , 98%	Please inquire	Please inquire
	DLM-276	D <sub>6</sub> , 98%	1 L	CODE K or BS
Ethylamine (75-04-7)	DLM-3857	D <sub>5</sub> , 98%	1 g	CODE K
Ethylene (74-85-1)	CLM-415	1,2- <sup>13</sup> C <sub>2</sub> , 99%	0.1, 0.25, or 0.5 L	BS
	DLM-6610	D, 98%	Please inquire	Please inquire
	DLM-2446	1,1-D <sub>2</sub> , 98%	Please inquire	Please inquire
	DLM-416	1,2-D <sub>2</sub> , 98% (cis/trans mix)	Please inquire	CODE K
	DLM-1530	cis-1,2-D <sub>2</sub> , 98%	Please inquire	Please inquire
	DLM-740	trans-1,2-D <sub>2</sub> , 98%	1 L	CODE K or BS
	DLM-347	D <sub>4</sub> , 98%	1 L	CODE K or BS
	CDLM-8024	<sup>13</sup> C <sub>2</sub> , 99%; D <sub>4</sub> , 98%	1 L	Please inquire
Ethylene oxide (75-21-8)	CLM-473	1,2- <sup>13</sup> C <sub>2</sub> , 99% (+ 0.1% hydroquinone stabilizer)	0.5 g	CODE C
Fluoromethane (593-53-3)	CLM-1014	<sup>13</sup> C, 99%	0.1 L	BS
	DLM-1015	D <sub>3</sub> , 99%	Please inquire	Please inquire
Isobutane (75-28-5)	DLM-1809	D <sub>10</sub> , 98%	1 L	CODE C or BS

Chemical purity (CP) is 98% or greater, unless otherwise indicated.

## Compounds (continued)

Compounds and Mixes (unlabeled CAS No.)	Catalog No.	Label and Enrichment	Unit	Typical Packaging
Krypton (7439-90-9)	KRLM-4656	<sup>78</sup> Kr, 99%	Please inquire	Please inquire
	KRLM-6794	<sup>82</sup> Kr, 99%	Please inquire	Please inquire
	KRLM-7397	<sup>86</sup> Kr	Please inquire	Please inquire
Methane (74-82-8)	CLM-392	<sup>12</sup> C, 99.99%	Please inquire	CODE U
	CLM-392-LN	<sup>12</sup> C, 99.99% (<14 ppm LN content)	Please inquire	CODE U
	CLM-392-ULN	<sup>12</sup> C, 99.99% (≤3 ppm ULN content)	Please inquire	CODE U
	CDLM-1616	<sup>12</sup> C, 99.95%; D <sub>4</sub> , 98%	1 L	CODE C
	CLM-429	<sup>13</sup> C, 99%	0.1 or 1 L	CODE C or BS
	CDLM-469	<sup>13</sup> C, 99%; D <sub>4</sub> , 99%	0.1 L	BS
	CLM-3590	<sup>13</sup> C, 99.9%	0.1 or 1 L	CODE C or BS
	DLM-1257	D, 98%	1 L	CODE C or BS
	DLM-1343	D <sub>2</sub> , 98%	1 L	CODE C or BS
	DLM-1344	D <sub>3</sub> , 98%	1 L	CODE C or BS
Methanethiol (74-93-1)	CLM-3961	<sup>13</sup> C, 99%	Please inquire	CODE K
	DLM-2643	D <sub>3</sub> , 99%	Please inquire	Please inquire
Methyl vinyl ether (107-25-5)	DLM-1623	methyl-D <sub>3</sub> , 98%	5 g	CODE C
Methylamine (74-89-5)	CLM-1617	<sup>13</sup> C, 99%	Please inquire	Please inquire
	DLM-1618	D <sub>2</sub> , 98%	Please inquire	Please inquire
	DLM-1500	D <sub>3</sub> , 98%	10 g	CODE B or K
	DLM-1501	D <sub>5</sub> , 98%	Please inquire	Please inquire
	NLM-1621	<sup>15</sup> N, 98%	Please inquire	CODE K
	CNLM-302	<sup>13</sup> C, 99%; <sup>15</sup> N, 99%	Please inquire	Please inquire
2-Methylpropene (115-11-7)	CLM-7250	2- <sup>13</sup> C, 99%	Please inquire	Please inquire
Nitric oxide (10102-43-9)	NLM-823	<sup>15</sup> N, 98%	Please inquire	Please inquire
Nitrogen (7727-37-9)	NLM-363	<sup>15</sup> N <sub>2</sub> , 98%	0.1, 0.25, 1, or 5 L	CODE C or BS
Nitrous oxide (10024-97-2)	NLM-1045	1- <sup>15</sup> N, 98%	Please inquire	CODE K
	NLM-1044	2- <sup>15</sup> N, 98%	Please inquire	CODE K
	NLM-1046	<sup>15</sup> N <sub>2</sub> , 98%	Please inquire	CODE K
Oxygen (7782-44-7)	OLM-213-70	<sup>17</sup> O <sub>2</sub> , 70%	Please inquire	Please inquire
	OLM-212	<sup>18</sup> O <sub>2</sub> , 97% (CP >99.8%)	Please inquire	CODE J
Phosphine (7803-51-2)	DLM-2703	D <sub>3</sub> , 98%	Please inquire	Please inquire
Propadiene (463-49-0)	DLM-4732	D <sub>4</sub> , 98%	Please inquire	Please inquire
Propane (74-98-6)	CLM-403	1- <sup>13</sup> C, 99%	0.1 L	BS
	DLM-3676	2,2-D <sub>2</sub> , 98%	Please inquire	Please inquire
	DLM-3476	1,1,1,3,3,3-D <sub>6</sub> , 98%	Please inquire	Please inquire
	DLM-153	D <sub>8</sub> , 98%	1 L	CODE K or BS
Propene (115-07-1)	CLM-4254	1- <sup>13</sup> C, 99%	Please inquire	Please inquire
	CLM-7210	2- <sup>13</sup> C, 99%	Please inquire	Please inquire
	CLM-1514	3- <sup>13</sup> C, 99%	0.1 L	BS
	DLM-4624	1,1-D <sub>2</sub> , 98%	Please inquire	Please inquire
	DLM-1626	3,3,3-D <sub>3</sub> , 98%	1 L	Please inquire
	DLM-304	D <sub>6</sub> , 98%	1 L	CODE K or BS
Propyne (74-99-7)	CLM-6188	1,2- <sup>13</sup> C <sub>2</sub> , 99%	Please inquire	Please inquire
	CLM-6189	1,2,3- <sup>13</sup> C <sub>3</sub> , 99%	Please inquire	Please inquire
	DLM-4303	1-D, 98%	Please inquire	Please inquire
	DLM-4302	methyl-D <sub>3</sub> , 98%	Please inquire	Please inquire
	DLM-4775	D <sub>4</sub> , 98%	Please inquire	Please inquire

Chemical purity (CP) is 98% or greater, unless otherwise indicated.

Continued ►

## Compounds *(continued)*

Compounds and Mixes (unlabeled CAS No.)	Catalog No.	Label and Enrichment	Unit	Typical Packaging
Trimethylamine (75-50-3)	DLM-4638	D <sub>8</sub> , 98%	Please inquire	Please inquire
	DLM-603	D <sub>9</sub> , 98%	5 g	CODE K
Vinyl bromide (593-60-2)	DLM-3344	D <sub>3</sub> , 98% (+ hydroquinone stabilizer)	Please inquire	Please inquire
Vinyl chloride (75-01-4)	CLM-472	<sup>13</sup> C <sub>2</sub> , 99% (+ hydroquinone stabilizer)	Please inquire	CODE K
	DLM-2390	1-D, 98%	Please inquire	Please inquire
	DLM-167	D <sub>3</sub> , 98% (+ hydroquinone stabilizer)	1 or 5 g	CODE B, M, or K
Xenon (7440-63-3)	XELM-428	<sup>124</sup> Xe, 99.9%	Please inquire	Please inquire
	XELM-430	<sup>129</sup> Xe, 99%	Please inquire	Please inquire
	XELM-8114	<sup>131</sup> Xe, 99%	Please inquire	Please inquire
	XELM-7261	<sup>132</sup> Xe, 99.5%	Please inquire	Please inquire
	XELM-8986	<sup>134</sup> Xe, 99%	Please inquire	Please inquire

Custom mixes can be formulated according to user specifications. Please inquire if an alternate gas or label is required.

Abbreviations: HD – deuterium hydride; LN – low nitrogen; ULN – ultra-low nitrogen.

## Calibration Standards

We are pleased to offer four CO<sub>2</sub> standards for use in <sup>13</sup>C-urea breath analysis. These gas calibration standards are designed to mimic <sup>13</sup>CO<sub>2</sub> levels in normal breath (baseline calibrant) and at three enriched levels (low-, mid-, and high-level calibrants). Each is gravimetrically prepared and analyzed for <sup>13</sup>C content by isotope ratio mass spectrometry (IRMS). The <sup>13</sup>C content for the baseline standard is expressed as delta value vs. PDB (Pee Dee Belemnite), with the enriched calibrant gases additionally reported as delta value above baseline (see lot-specific CoA for details).

Catalog No.	Description*	Unit	Stock Packaging
CLM-10584	5% CO <sub>2</sub> in air baseline calibrant gas	10 or 50 L	CODE C or G
CLM-10585	5% CO <sub>2</sub> in air low-level calibrant gas	10 or 50 L	CODE C or G
CLM-10586	5% CO <sub>2</sub> in air mid-level calibrant gas	10 or 50 L	CODE C or G
CLM-10587	5% CO <sub>2</sub> in air high-level calibrant gas	10 or 50 L	CODE C or G

## References

Lynch, L.M.; Machmuller, M.B.; Cotrufo, M.F.; et al. **2018**. Tracking the fate of fresh carbon in the Arctic tundra: Will shrub expansion alter responses of soil organic matter to warming? *Soil Biol and Biochem*, 120, 134-144.

Maity, A.; Pal, M.; Maithani, S.; et al. **2016**. Molecular hydrogen in human breath: a new strategy for selectively diagnosing peptic ulcer disease, non-ulcerous dyspepsia and *Helicobacter pylori* infection. *J Breath Res*, 10(3), 036007.

Som, S.; De, A.; Banik, G.D.; et al. **2015**. Mechanisms linking metabolism of *Helicobacter pylori* to (<sup>18</sup>O) and (<sup>13</sup>C)-isotopes of human breath CO<sub>2</sub>. *Sci Rep*, 5, 10936.

Maity, A.; Banik, G.D.; Ghosh, C.; et al. **2014**. Residual gas analyzer mass spectrometry for human breath analysis: a new tool for the non-invasive diagnosis of *Helicobacter pylori* infection. *J Breath Res*, 8(1), 016005.

Chemical purity (CP) is 98% or greater, unless otherwise indicated.

## Gas-Packaging Options

Catalog No.	Specification*	Max. or Service Pressure†
<b>Carbon Steel Lecture Bottles (440 mL)</b>		
CODE A	1/4" NPT brass bellows valve (male, straight pattern)	1000 psi
CODE B	1/4" NPT stainless steel bellows valve (male, straight pattern)	1000 psi
CODE Q	1/4" NPT stainless steel valve (male, straight pattern)	1800 psi
CODE C	CGA 110/170 brass valve (angle pattern)	1800 psi
CODE M	CGA 110/180 aluminum-silicon-bronze valve (angle pattern)	1800 psi
CODE F	CGA 350 packless brass diaphragm valve (angle pattern)	1800 psi
CODE N	CGA 580 packless brass diaphragm valve (angle pattern)	1800 psi
<b>Carbon Steel Cylinders (3, 8, or 44 L)‡</b>		
CODE G	CGA 580 packless brass diaphragm valve (angle pattern)	1800 psi
CODE H	CGA 350 packless brass diaphragm valve (angle pattern)	1800 psi
CODE L	CGA 350 packless brass diaphragm valve (angle pattern)	1800 psi
CODE T	CGA 320 packless brass diaphragm valve (angle pattern)	1800 psi
<b>Stainless Steel Lecture Bottles (75, 150, 440 mL)</b>		
CODE I	1/4" NPT brass bellows valve (male, straight pattern)	1000 psi
CODE J	1/4" NPT stainless steel bellows valve (male, straight pattern)	1000 psi
CODE K	1/4" NPT stainless steel valve (male, straight pattern)	1800 psi
<b>Aluminum Cylinders (1, 2.9, or 10.5 L)</b>		
CODE U	CGA 350 brass valve (for flammable gases)	1800 psi (for 1 L), 2015 psi (for 2.9 L), 2216 psi (for 10.5 L)
<b>Fittings</b>		
CODE O	CGA 110 to 1/4" NPT brass adaptor	N/A
CODE P	CGA 110 to 1/4" NPT stainless steel adaptor	N/A
CODE S	CGA 180 to 1/8" NPT stainless steel adaptor	N/A
<b>Regulators</b>		
CODE R	CGA 170 control valve for CODE C lecture bottles	N/A
CODE X	CGA 580 HPT 500 two-stage brass regulator (for noncorrosive gases)	N/A
CODE Y	CGA 170 regulator for CODE C lecture bottles (for noncorrosive gases)	N/A
<b>Breakseal Flasks (0.1, 0.25, 0.5, or 1 L)</b>		
BS	Breakseal flask	Atmospheric (atm)
<b>Breath Test</b>		
BT-LB-KIT	Breath test adaptor set for use with CGA 110/170 lecture bottle	N/A
BT-3L-KIT	Breath test adaptor set for use with CGA 580 cylinder	N/A
BTB-300-25	Breath test bags (aluminum lined) 300 mL for time course breath test sample	N/A
BTB-1300-20	Breath collection bag (aluminum lined) 1300 mL for baseline breath test	N/A

\* Abbreviations: CGA – Compressed Gas Association; HPT – High Purity Dual Stage; NPT – National Pipe Thread; N/A – not applicable.

† All are DOT maximum pressure stampings with the exception of Code U.

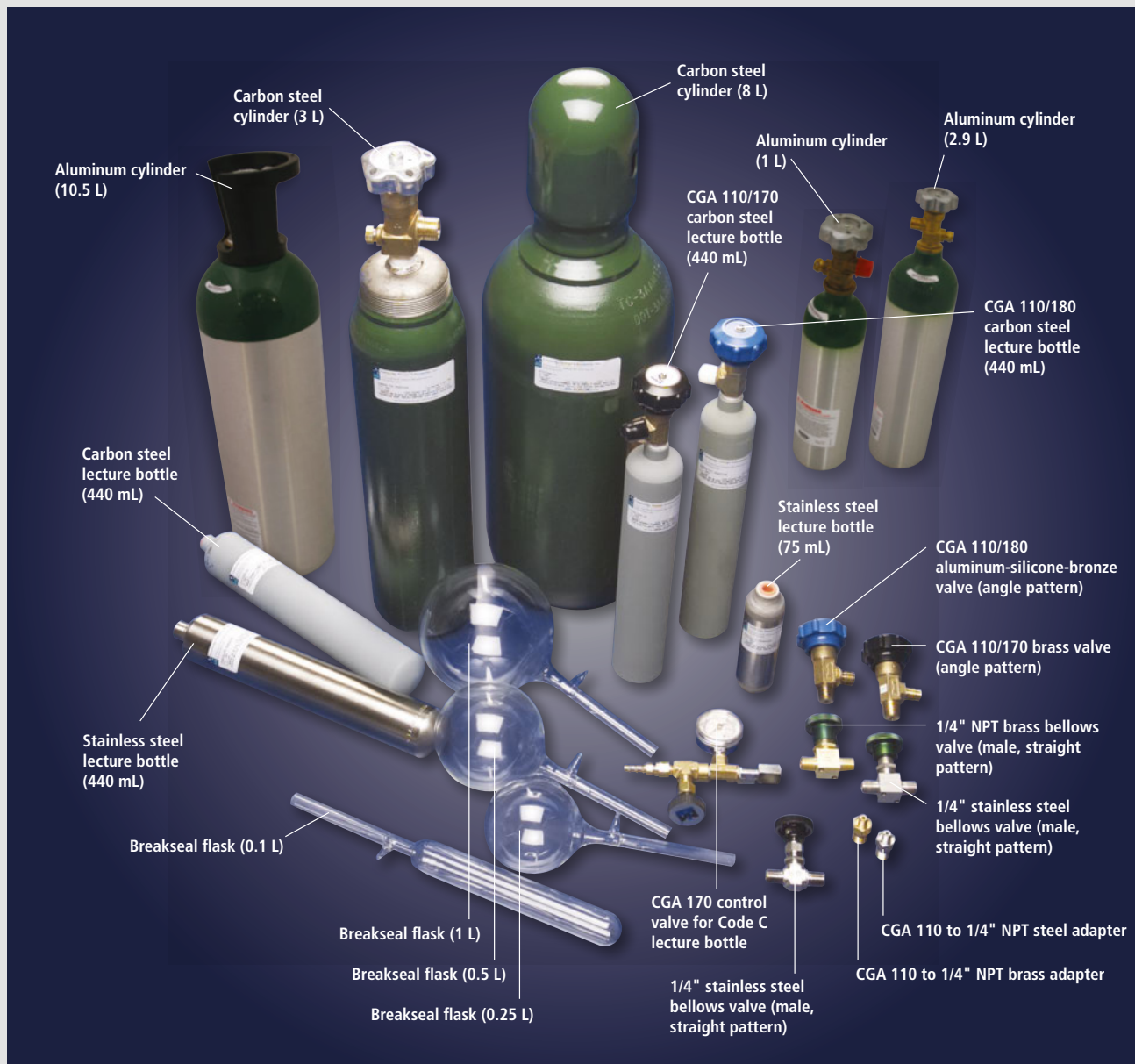
‡ Codes G, H, and T refer to the 3 or 8 L cylinder options. Code L refers to 44 L.

### Notes

1. Carriers may add additional freight charges for handling/transporting certain materials. There may also be freight restrictions for certain materials, such as carbon monoxide, ammonia, deuterium chloride, and bromomethane. Please refer to our website for products not listed here.
2. Gases packaged in 10.5 L (code U) or 8 L (code G, H, and T) cylinders can be shipped by FedEx Ground, UPS Ground, or truck. Gases packaged in 44 L (code L) cylinders can only be shipped by truck or boat due to cylinder weight.
3. The CGA 580 valve is for nonflammable gases and the CGA 350 for flammable gases.
4. The appropriate regulator for Code C is CGA 170 (catalog no. Y11-L215DLB, Airgas). Its maximum outlet pressure is 60 psig, and inlet gauge range is 0-3,000 psig.
5. The breakseal flasks (BS) are packaged at 1 atm (14.7 psi).
6. All cylinders are inspected and leak tested before filling. CIL nonetheless recommends that the cylinders be inspected and weighed upon receipt to ensure that the product and/or packaging was not compromised during shipment.
7. The following gases liquefy at low pressure: 1,3-butadiene at ~21 psi, propane at ~109 psi, ammonia at ~129 psi, ethane at ~543 psi, and carbon dioxide at ~845 psig. For converting to psig or psia, the atmospheric pressure at sea level is 14.7 psi.

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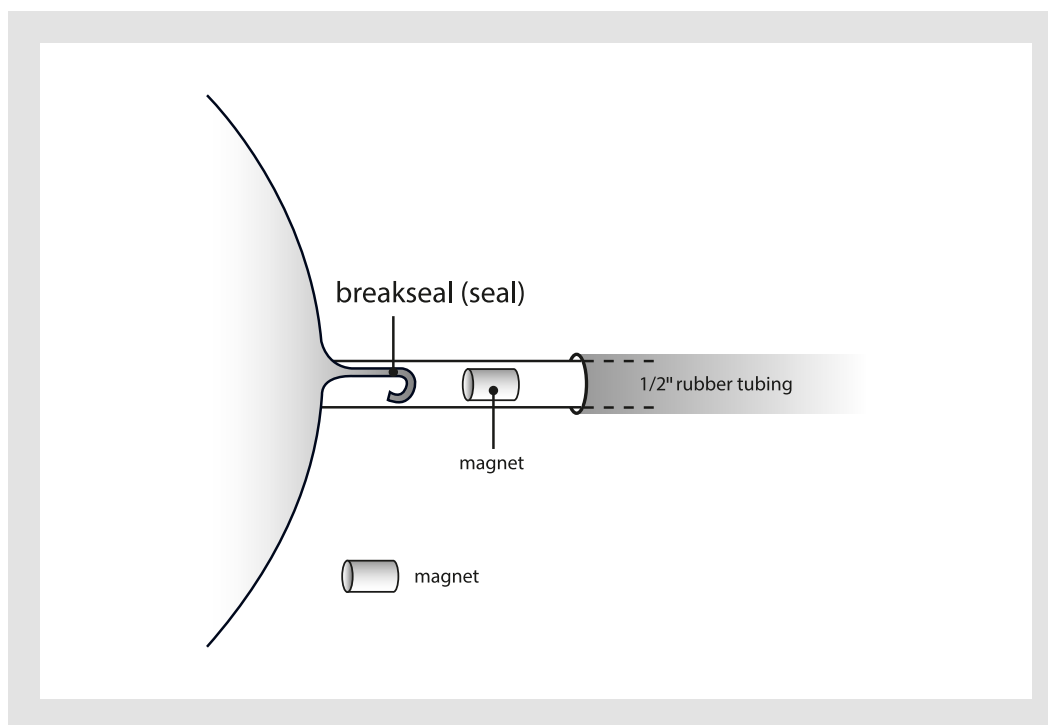
Gas-Packaging Options (continued)



## Breakseal Flasks – Instructions for Use

Breakseal flasks are used for adding a gas directly to a reaction container. They are intended for a single use within a closed system. Two magnets are used to break the seal; the gas is released from the breakseal flask into the system.

1. Inspect the breakseal flask prior to use to ensure the product/packaging has not been compromised.
2. Place a small metal weight into the end of the breakseal. Carefully attach ½" tubing to the breakseal (see schematic below). Do not allow the weight to damage the seal.
3. Attach the breakseal to the reaction container using the rubber tubing (see figure below).
4. Evacuate tubing and clamp off the vacuum.
5. To add the gas to the reaction, use a magnet on the outside of the glass to manipulate the magnet inside the neck of the breakseal to break the glass.
6. After the gas has been added, clamp off the tubing in two places (between the reaction and the breakseal). This will prevent any residual gas from escaping.
7. Cut the tubing between the clamps.
8. Dispose of the breakseal and residual glass properly.



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