

# Stable isotope ratio reference gases



Petroleum geochemistry

## Pioneering innovation

Gaseous stable isotope mixtures **enhance reliability of analysis with precise calibration** when it becomes critical to measure  $\delta$  values accurately.

## Isotopic analysis

Gaseous stable isotopes are used to help understand the formation mechanisms and compositional evolution of gas accumulations. This provides necessary information for petroleum system modeling and reservoir management enabling accurate exploration and production development planning.

# Air Liquide - pushing the frontiers

Air Liquide has developed a unique **standard product** range of multi-component, natural gas calibration mixtures (from C1-C5) with specific  $\delta^{13}\text{C}$  and  $\delta^2\text{H}$  ratios.

On demand mixtures with customer specific molecular (from ppm to %) and isotopic compositions are available:		
1	C1 with $\delta^{13}\text{C} = -69$ to $0$ ‰	with $\delta^{13}\text{C}$ adjustment
2	C2 with $\delta^{13}\text{C} = -28$ ‰	
3	C3 with $\delta^{13}\text{C} = -32$ or $-22$ ‰	
4	C4 with $\delta^{13}\text{C} = -30$ ‰ $\delta^{13}\text{C}$	
5	C5 with $\delta^{13}\text{C} = -25$ ‰ $\delta^{13}\text{C}$	

Other components such as  $\text{H}_2\text{S}$ ,  $\text{N}_2$ ,  $\text{N}_2\text{O}$ ,  $\text{CO}$ ,  $\text{H}_2$ , and  $\text{CO}$  with specific  $\delta^{34}\text{S}$ ,  $\delta^{15}\text{N}$ ,  $\delta^{13}\text{C}$ ,  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$  isotope ratios are also offered.

## Biogenic mixtures

Biogenic		$\text{CH}_4$			$\text{C}_2\text{H}_6$	$\text{C}_3\text{H}_8$	Balance Gas
		High	Middle	Low			
Bio 1.0 <i>in Air</i>	Conc. (v/v)	2.5 %	2500 ppm	250 ppm			Balance Air
	$\delta^{13}\text{C}$ (‰ VPDB)	-69	-69	-69			
	$\delta\text{D}$ (‰ VSMOW)	-235	-235	-235			
Bio 2.0	Conc. (v/v)	95 %			1 %		Balance $\text{N}_2$
	$\delta^{13}\text{C}$ (‰ VPDB)	-69			-30		
Bio 3.0	Conc. (v/v)	95 %			0,9 %	0,1 %	Balance $\text{N}_2$
	$\delta^{13}\text{C}$ (‰ VPDB)	-69			-30	-30	

## Thermogenic mixtures

Thermogenic		CH <sub>4</sub>			C <sub>2</sub> H <sub>6</sub>	C <sub>3</sub> H <sub>8</sub>	nC <sub>4</sub> H <sub>10</sub>	iC <sub>4</sub> H <sub>10</sub>	nC <sub>5</sub> H <sub>12</sub>	iC <sub>5</sub> H <sub>12</sub>
		High	Middle	Low						
Thermo 1.1 <i>in Air</i>	Conc. (v/v)	2.5 %	2500 ppm	250 ppm						
	δ <sup>13</sup> C (‰ VPDB)	-45	-45	-45						
	δD (‰ VSMOW)	-150	-150	-150						
Thermo 1.2 <i>in Air</i>	Conc. (v/v)	2,5 %	2500 ppm	250 ppm						
	δ <sup>13</sup> C (‰ VPDB)	-25	-25	-25						
	δD (‰ VSMOW)	-120	-120	-120						
Thermo 2.0	Conc. (v/v)	80 %			15 %	5 %				
	δ <sup>13</sup> C (‰ VPDB)	-40			-30	-25				
Thermo 3.0	Conc. (v/v)	75 %			10 %	8 %	3 %	2 %	1 %	1 %
	δ <sup>13</sup> C (‰ VPDB)	-40			-30	-28	-28	-30	-25	-25

## Carbon Dioxide mixtures

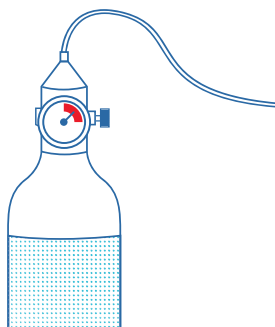
CO <sub>2</sub> in Air	CO <sub>2</sub> *	
Carbon Dioxide 1.1	Conc. (v/v)	50%
	δ <sup>13</sup> C (‰ VPDB)	-40
Carbon Dioxide 1.2	Conc. (v/v)	50 %
	δ <sup>13</sup> C (‰ VPDB)	-25
Carbon Dioxide 1.3	Conc. (v/v)	50 %
	δ <sup>13</sup> C (‰ VPDB)	+25

\* δ<sup>18</sup>O (‰ VSMOW) ratios in the range of -8 to +8

Depending on customer needs, use of other appropriate cylinder packages and configurations can be investigated and made available.

## Packaging

- Gas Volume: 34 Liters (1.2CF)
- Water Volume: 1 Liter
- Pressure: 500 psig (34bar)
- Cylinder Material: Aluminum
- Weight: 0.8 lbs. (0.4kg)



- ✓ Strong expertise
- ✓ Easy to reach
- ✓ Reliable service

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