



*Works for me*

# **FLAMAL™** Gases

High Performance  
Solutions for the Metal  
Fabrication Industry





There is no single solution to every challenge faced in today's industrial business world. To get an edge on your competitors you need to optimize your processes. **FLAMAL** gases can give you that edge, no matter what flame process you use.

## The **FLAMAL** Advantage

### Acetylene $C_2H_2$

The original fuel gas used world wide for over 100 years. Still the best choice for many applications. Its triple bonds release large quantities of energy when oxidized in the oxy-acetylene flame. Acetylene burns with the highest flame temperature of all the common fuel gases and produces a very concentrated heat.

An unstable hydrocarbon, acetylene must be handled with care. Air Liquide's many innovations provide the safest acetylene cylinders on the market:

- **ALTOP™** and **MINITOP™** cylinders with integrated pressure regulators and protective safety enclosure
- Tulip caps that remain in place at all times to protect against valve damage\*
- Unique CGA 410 valve outlet to prevent mismatch with equipment designed for LPG fuel gases\*

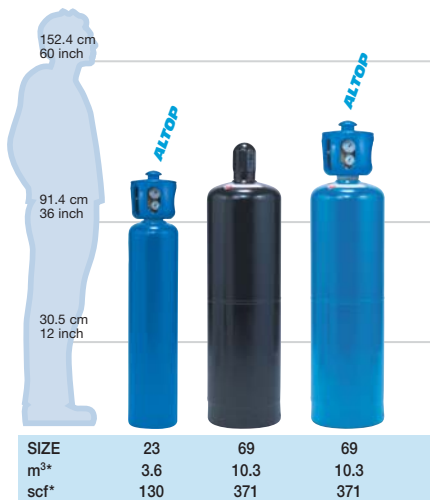
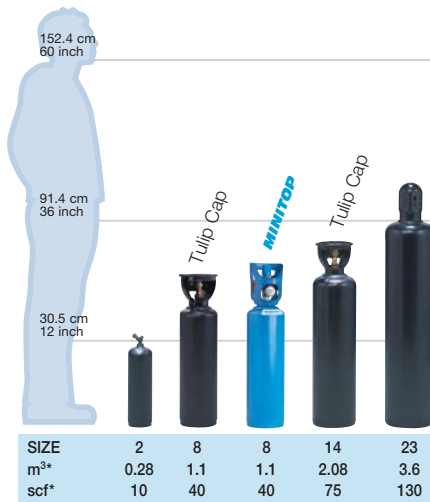
Specially constructed cylinders with porous filling. Acetylene gas is dissolved in a solvent for safe handling and transportation. Cylinders are pressurized to 1724 kPa (250 psig) at 15°C.

Capacities range from 0.28 m<sup>3</sup> (10 ft<sup>3</sup>) to 10.30 m<sup>3</sup> (371 ft<sup>3</sup>).

Maximum withdrawal rate from a cylinder **should be limited to 1/7 of its nominal capacity** per hour to avoid solvent extraction. Multiple cylinders should be manifolded together where higher flowrates are required.

\* Certain cylinder sizes

**Note: Do Not use acetylene with materials that contain more than 65% copper (cutting, heating and welding tips excluded).**



\* All approximate measures  
5' 10" Man shown for cylinder proportion

Optimize your flame process:

- Gain Productivity
- Improve Quality
- Reduce Losses and Waste
- Operate more Safely

... choose the best option for your application.



## FLAMAL™ 29 C<sub>3</sub>H<sub>6</sub>

A stable, propylene-based, high-energy fuel gas that combines the best performance characteristics of acetylene with the safety and convenience features of propane. **FLAMAL 29** has a flame temperature second only to acetylene among the common fuel gases due to its double bond between carbon atoms. When burning, **FLAMAL 29** produces 70% more heat in its primary flame than propane does, and twice the secondary flame heat of acetylene.

This unique balance of heat distribution provides fast starts for cutting and piercing as well as efficient BTU transfer in heating applications, making **FLAMAL 29** the most versatile of fuel gases.

Supplied in liquid form under a vapour pressure of 931 kPa (135 psig) at 21°C. Cylinders are of light-weight, welded steel construction. While cylinder pressure and withdrawal rate vary with ambient temperature, **FLAMAL 29** has the highest vapourization rate of the liquefied fuel gases, a definite advantage in both low temperature and high flow applications.

FLAMAL 29 is available in a wide range of container sizes with volumes from 5.7 kg (12.6 lb) in cylinders to 7500 L (2000 gal) bulk storage tanks.

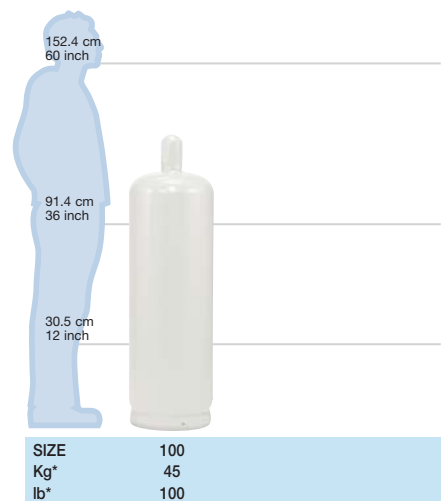
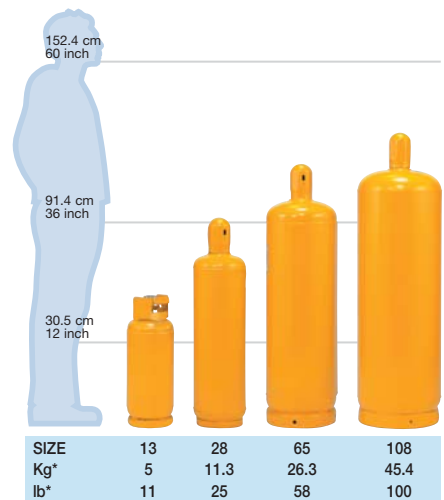
## Propane C<sub>3</sub>H<sub>8</sub>

A liquefied petroleum gas that provides good performance in applications that require overall heat content at an economical cost. Propane does not possess the double and triple bonds found in acetylene and **FLAMAL 29** so does not develop their high flame temperatures or concentrated heat, but its secondary flame produces a high BTU output.

Low pressure welded steel cylinders are used for propane. Most common cylinder capacity: 100 lb\*\*.

Propane is supplied in liquid form under a vapour pressure of 827 kPa (120 psig) at 21°C. Like **FLAMAL 29**, withdrawal rate and vapour pressure vary with temperature.

\*\* Check for availability at your local store



\* All approximate measures  
5' 10" Man shown for cylinder proportion



Select from a wide variety of package sizes, cylinder types and supply modes.

**FLAMAL** offers the choice.

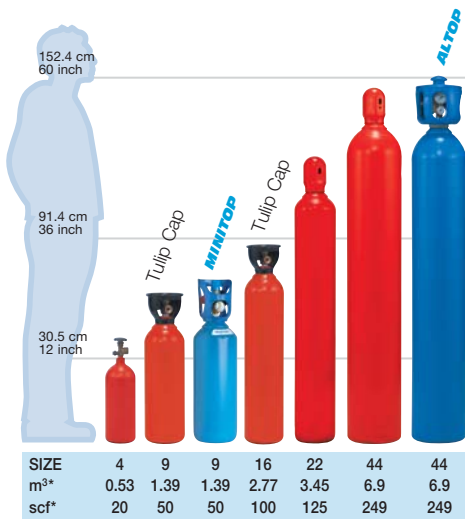
## Oxygen

The companion to all fuel gases that, when combined in optimum proportions, produces the flames that do the work. Although non-flammable itself, it is the oxidizer that breaks the hydrocarbon bonds to release the potential energy they contain. In cutting, the pure oxygen jet “burns” the steel and blows the molten oxides from the kerf.

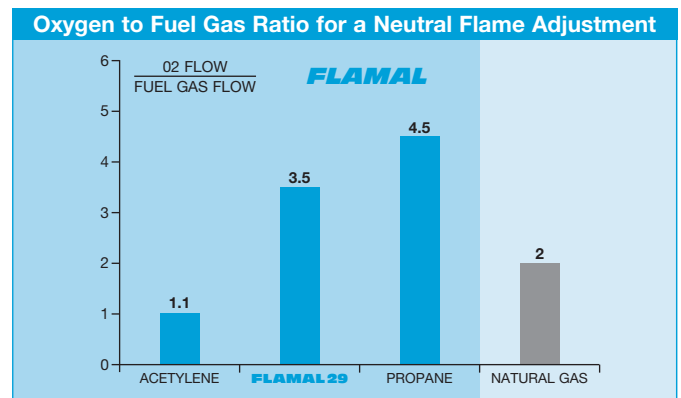
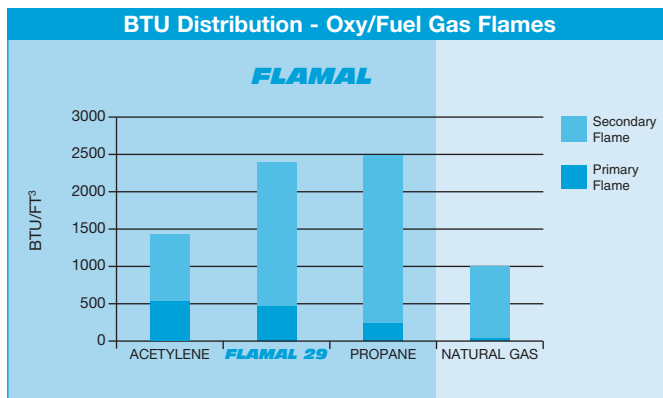
Available in seamless, high-strength low alloy steel cylinders with volumes from 0.53 m<sup>3</sup> (20 ft<sup>3</sup>) to 6.90 m<sup>3</sup> (248.8 ft<sup>3</sup>), and bulk packs of 16 cylinders containing a total of 150 m<sup>3</sup> (5400 ft<sup>3</sup>). Cylinder pressure varies from 14960 kPa (2217 psig) to 17820 kPa (2640 psig) depending on the cylinder.

Air Liquide recommends oxygen in **ALTOP** or **MINITOP** packaging for safe, easy and economical gas control. Certain oxygen cylinders are provided with tulip caps that remain in place at all times to protect against valve damage.

As volume needs increase, oxygen can be supplied in liquid cylinder form or bulk storage tanks containing up to 49200 L (13000 gal).



\* All approximate measures  
5' 10" Man shown for cylinder proportion



There's a **FLAMAL** gas that meets your needs.

Ask us for an analysis of your oxy-fuel operations and our recommendations.



## **FLAMAL** Applications

### Flame Cutting

Acetylene is hard to beat on thicknesses under 10 mm (3/8"). Its concentrated heat starts fastest and produces the highest cutting speeds on thin material.

**FLAMAL 29** excels as thickness increases, due to the heat distribution between its primary and secondary flames. **FLAMAL 29** starts fast and is ideal for piercing, bevelling and shape cutting.

Propane works well cutting heavy sections over 100 mm (4") or in scrap cutting, where speed or cut quality may not be as much of a factor.



### Gas Welding

Acetylene is the only real choice for fusion welding of steel. Its unique flame properties allow good puddle control and deep penetration without oxidation and porosity.



### Soldering, Brazing and Braze Welding

For these joining processes where the base metal is not melted, **FLAMAL 29** is best suited for its heat distribution profile and convenience of use. Acetylene and propane can also be used.

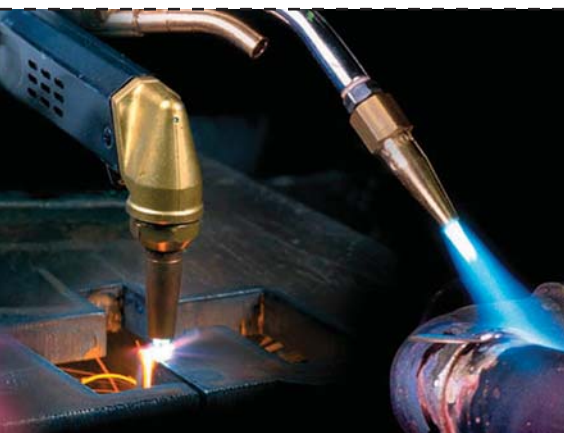


### Heating, Bending and Straightening

Where a large quantity of energy needs to be transferred quickly and efficiently to the workpiece, **FLAMAL 29** is the fuel gas of choice. Its heat transfer properties and comparatively low combustion ratio make it efficient and economical.

Propane can be used to supply similar heating capacity but will consume more oxygen.



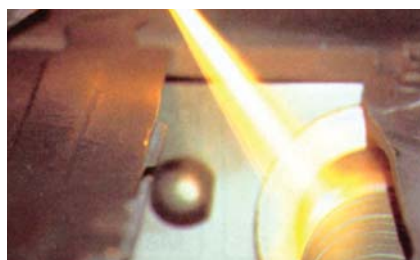


Air Liquide has over 100 years of experience providing oxygen and fuel gases to the metal fabrication industry.



### Flame Hardening

Rapid heating to high temperature, for controlled hardness and case depth, can best be achieved with the acetylene or **FLAMAL 29** flame.



### Thermal Spray

High operating pressure capability, and the possibility to vary the reducing nature of the flame give **FLAMAL 29** an advantage in flame spray applications.

Acetylene is also suitable where its lower operating pressure limit can be tolerated. Its high flame temperature is required where high melting point coatings are used.

### Other Specialized Uses

Acetylene and **FLAMAL 29** find many other applications due to their useful flame properties:

- Quick, high quality granite surfacing
- Carbon black production for mold lubrication
- Underwater cutting

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### Transport your cylinders safely

AIR LIQUIDE recommends that you do not transport your cylinders in a non ventilated trunk or space of a vehicle.

- Close the cylinder valves
- Disconnect the equipment
- Ensure cylinders are tightly secured
- Keep your vehicle well ventilated
- Do not leave cylinders inside the vehicle for prolonged periods



Know the facts, protect yourself and your tradesmen.

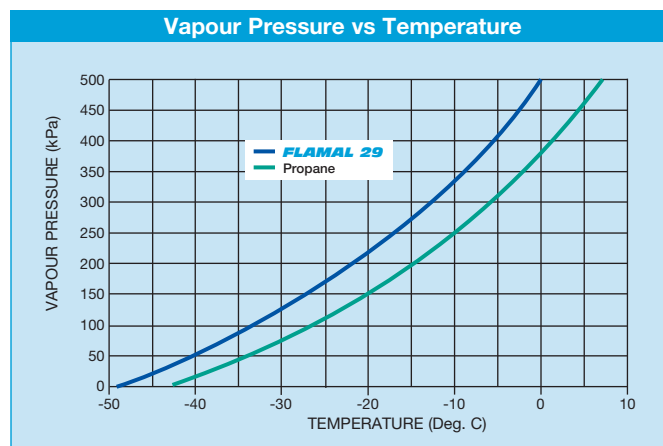
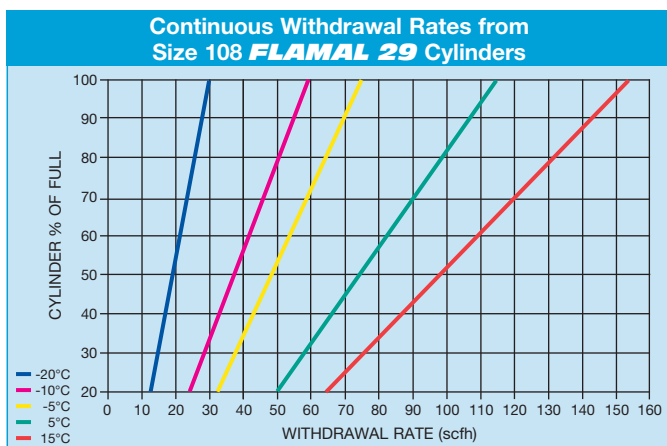
Ask us for safety and product training.



## FLAMAL Properties

Compare the leading gases:

	<b>FLAMAL</b>			
	ACETYLENE	FLAMAL 29	PROPANE	NATURAL GAS
SAFETY DATA	C <sub>2</sub> H <sub>2</sub>	C <sub>3</sub> H <sub>8</sub>	C <sub>3</sub> H <sub>8</sub>	CH <sub>4</sub>
Shock sensitivity	Unstable	Stable	Stable	Stable
Explosive Limits in Air (%)	2.2 – 80	2.0 – 10.5	2.2 – 9.5	5.0 – 15
Maximum Allowable Use Pressure, kPa (psig)	103 (15)	Cylinder	Cylinder	Line
Burning Velocity in Oxygen, m/sec (ft/sec)	7.6 (24.9)	3.90 (12.8)	3.31 (10.9)	3.90 (12.8)
Backfire Tendency	High	Low	Low	Low
Toxicity	Low	Low	Low	Low
PHYSICAL PROPERTIES				
Specific Gravity of Liquid (water = 1)	—	0.522	0.507	—
Weight of liquid, kg/l, (lb/gal (US))	—	0.52 (4.35)	0.51 (4.28)	—
Specific volume, m <sup>3</sup> /kg (ft <sup>3</sup> /lb)	0.91 (14.6)	0.56 (9.06)	0.54 (8.66)	1.47 (23.6)
Specific Gravity of Gas (air = 1)	0.906	1.48	1.52	0.62
Cylinder Pressure at 21° C (70° F) kPa (psig)	1724 (250)	931 (135)	827 (120)	—
Boiling Point, ° C (° F) at atm pressure	-83.8 (-118.8)	-47.7 (-53.8)	-42 (-43.6)	-161.5 (-258.7)
HEATING VALUES				
Neutral Flame Temperature, ° C (° F)	3087 (5589)	2867 (5193)	2526 (4579)	2538 (4600)
Heat Emission, BTU/ft <sup>3</sup> , primary flame	507	433	255	11
secondary flame	963	1.938	2.243	989
Total BTU/ft <sup>3</sup>	1.470	2.371	2.498	1.000
Total Heat Value, BTU/lb	21.500	21.500	21.600	23.600



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1-800-817-7697

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