



## Did you know... ?

### HOW DOES MY CO<sub>2</sub> PROPANE GENERATOR WORKS ?



#### COMBUSTION BASIC CONCEPTS

Applicable to propane combustion in the air as observed in a CO<sub>2</sub> generator:

- On Earth, the air is mainly composed of 79% nitrogen and of 21% oxygen.
- When propane combustion occurs in the air, it's essentially the oxygen that ignites and maintains the combustion.  
**NO OXYGEN, NO COMBUSTION !**
- When a **PERFECT COMBUSTION** occurs, the propane and air mixture take over the available oxygen. So, there is 0% oxygen left in the flue gas, which mainly contains **carbon dioxide (CO<sub>2</sub>)** and **water vapor (H<sub>2</sub>O)**.

#### PERFECT PROPANE COMBUSTION DOES NOT EXIST...

In real life, there are two possible combustions :

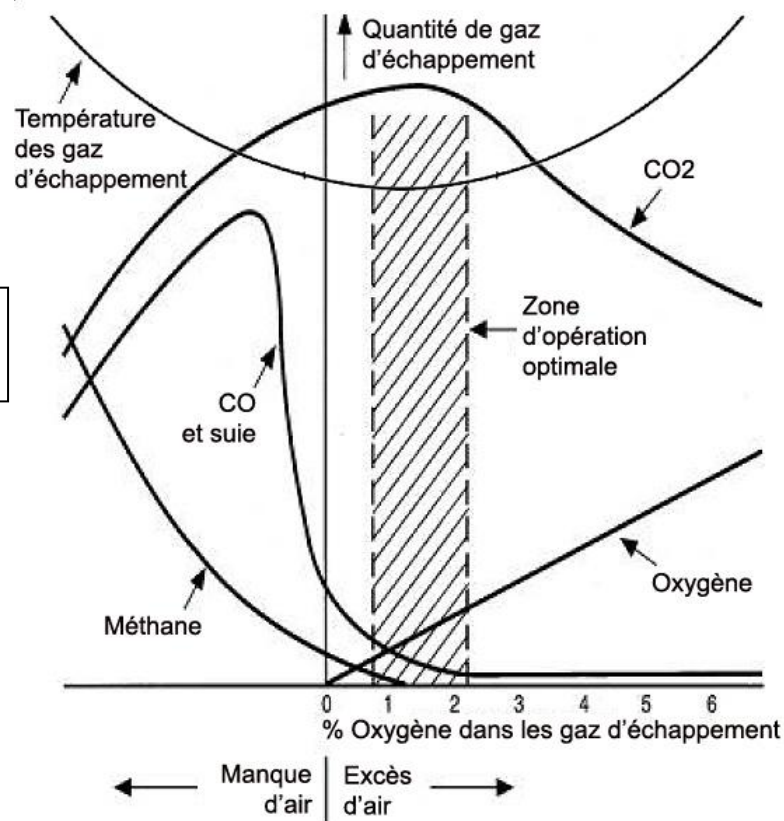
- The « excess air » combustion type : a clean burner will work in the optimal operating zone where about 2-3% of oxygen is in the flue gas. In this case, the burner generates lesser quantity of carbon dioxide and soot for a **maximum quantity of CO<sub>2</sub>**.

WHEN OUTDOOR CONDITIONS ALLOWS IT, Grozone Control LP5 & LP10 CO<sub>2</sub> GENERATORS, new or well maintained, will always operate in this zone and be safe at all times.



- air, The « air shortage » combustion type : a clogged-up burner, an almost-empty propane tank, a lack of fresh pollution particles in the air... these are factors that make your burner emanate noticeable carbon dioxide. Use caution while performing maintenance on your burner.

How do I know if my generator is working in **AIR SHORTAGE** combustion ? Answer at page 2...





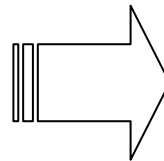
**HOW DO I KNOW IF MY CO<sub>2</sub> PROPANE GENERATOR IS WORKING IN AIR SHORTAGE COMBUSTION AND MAY BE A POSSIBLE SOURCE OF CARBON DIOXYDE ?** Page 2 of 4

**ANSWER :**

THE ONLY TECHNICAL AND ACCEPTABLE ANSWER FOR YOUR SAFETY IS : « PURCHASE A CARBON DIOXYDE DETECTOR »

There is NO RULE OF THUMB to judge the presence of combustion-related carbon dioxide. The flame color, exhaust gas temperature and the presence of soot are elements that indicates that combustion may not be perfect, BUT they don't confirm the presence of carbon dioxide in your environment.

Here are 2 models with displays that indicates the carbon dioxide ppm level (parts per million, 1 ppm = 1/10000 of 1%). It is possible to find the same products under different brand names as per example : **Garisson** (at Canadian Tire store) or **Kidde** (Rona, Zellers, Home Hardware, BMR, Costco, Canac Marquis).



**Annex #1 will show you acceptable levels versus harmful carbon monoxide concentration (in PPM) in your environment**

Briefly...

**Under 10 ppm** : may be acceptable and not harmful, depending on your health.

**Over 30 ppm** : gives you clues that you may have a bad/weak combustion. You should have a close look at it.



**Over 70 ppm** : will turn the alarm ON within One to Four hours.

Model with display screen sold from 50\$ to 55\$    Model with display screen sold from 60\$ to 65\$

Note : The information shown is current as of April 2011.

**NOTE : CO<sub>2</sub> (DIOXYDE) and CO (MONOXYDE) concentrations are measured in PPM (parts per million).**

**HOWEVER... it is IMPOSSIBLE to rely on a CO<sub>2</sub> reading to evaluate the actual CO level in a room.**

<p style="text-align: center;"><b><u>CARBON DIOXYDE(CO<sub>2</sub>) PPM</u></b></p> <p>Higher the level, happier are the plants. <b>A reading between 1000 and 2000 PPM</b> Is seen on a regular basis and is not harmful for humans.</p>  <p><b><u>Caution : 1000 to 2000 PPM of carbon monoxide IS really harmful.)</u></b></p> <p style="text-align: center;"><b>Grozone Control produces CO<sub>2</sub> controllers <u>ONLY</u>.</b></p>	<p style="text-align: center;"><b><u>CARBON MONOXYDE(CO)PPM</u></b></p> <p>Higher the level, greater is the DANGER for humans... <b>A reading over 30 PPM</b> Indicates a faulty burner. BE CAREFULL.</p>  <p style="text-align: center;"><b>Grozone CO<sub>2</sub> Controllers CAN'T measure CO level.</b></p>
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## WHAT ARE THE ACCEPTABLE CARBON MONOXYDE LEVELS IN MY ENVIRONMENT ?

### Explanatory notes and sources :

**Notice board 1** : Health Canada gives national ambient air quality objective recommendations under the form for carbon monoxide as well as for ambient air. (<http://www.hc-sc.gc.ca/ewh-semt/pubs/air/naaqo-onqaa/carbon-monoxycle-carbone/index-eng.php>).

**Notice board 2** : The Canada Mortgage & Housing Corporation (CMHC) offers practical and detailed results.

### Notice Board 1 – Ambient air quality national objectives recommended for carbon monoxide

Level	Recommended time for carbon monoxide exposure
0-5 ppm	Desirable maximum reach for 8 hours
6-12 ppm	Acceptable maximum reach for 8 hours
13-14 ppm	Desirable maximum reach for 1 hour
15-19 ppm	Tolerable Maximum reach for 8 hours
20-35 ppm	Acceptable maximum reach for 1 hour

### Notice board 2 – Carbon monoxide concentrations and related effects

<b>0 to 2 ppm concentration</b> Normal indoor-outdoor conditions for Canadian homes.
<b>11 ppm concentration</b> Acceptable maximum concentration for an 8-hour period <sup>(1)</sup> .
<b>25 ppm concentration</b> Acceptable maximum concentration in which a healthy adult can continuously be exposed for an 8-hour period <sup>(1)</sup> .
<b>30 ppm concentration</b> The CO warning device will not trigger the alarm unless the concentration is maintained for 30 days <sup>(2)</sup> .
<b>70 ppm concentration</b> The CO warning device will trigger the alarm within 1 to 4 hours <sup>(2)</sup> .
<b>150 ppm concentration</b> The CO warning device will trigger the alarm within 10 to 50 minutes <sup>(2)</sup> .
<b>200 ppm concentration</b> Light headache, tiredness, dizziness and nausea are felt after 2 to 3 hours. The CO warning device will trigger the alarm within 35 minutes <sup>(3)</sup> .
<b>400 ppm concentration</b> The CO warning device will trigger the alarm within 4 to 15 minutes <sup>(2)</sup> .
<b>800 ppm concentration</b> Dizziness, nausea and convulsions within 45 minutes, DEATH within 2 to 3 hours <sup>(3)</sup> .
<b>1 600 ppm concentration</b> DEATH within 1 hour <sup>(3)</sup> .
<b>13 000 ppm concentration</b> DEATH within 1 to 3 minutes <sup>(3)</sup> .

<sup>(1)</sup> Canada Health, Exposure Directions regarding Homes air quality, Supply minister and Service Canada, 1989.

<sup>(2)</sup> Canadian standards association, *CAN/CSA 6.19-01 : Residential Carbon Monoxide Detectors*, Canada, 2001.

<sup>(3)</sup> T.H. Greiner, *Carbon Monoxide Poisoning (AEN-172)*, Ames : Iowa State University of Science and Technology, 1997.

**Last revision : 2010.**

**SOURCE : Carbon monoxide fact sheet, Canada Mortgage & Housing Corporation.**

[http://cmhc.ca/en/co/maho/yohoyohe/inaiqu/inaiqu\\_002.cfm](http://cmhc.ca/en/co/maho/yohoyohe/inaiqu/inaiqu_002.cfm)



**WHAT ARE THE POINTS TO BE OBSERVED WHEN AIR-SHORTAGE COMBUSTION OCCURS ?**

**IMPORTANT NOTICE**

There is NO RULE OF THUMB to confirm the presence of carbon monoxide issued during combustion.  
 ONLY A CARBON MONOXYDE DETECTOR will confirm CO presence and measurements in the environment.

**Here are a few observable behaviors from your propane burner :**

<p><b>FLAME COLOR</b> (related to flame temperature)</p>	<ul style="list-style-type: none"> <li>● The flame color depends mainly of its temperature. The flame is blue when the burning is optimal and turns orange when it cools down.</li> <li>● The flame cools down when there is an air excess (blowing the energy outside the flame) or an air shortage (because of a less efficient burn).</li> <li>● An orange flame can mean AIR SHORTAGE (DANGER!!!) or a cool down flame caused by an AIR EXCESS (NO DANGER, but bad for your heating system since you may have a leak somewhere).</li> <li>● Generally blue, the burning propane's flame color is influenced by the shape, size and type of burners.</li> <li>● A blue flame can easily turn orange, according to air circulation, pollution or airborne particles in the surroundings.</li> <li>● The CARBON MONOXYDE is <b>COLOURLESS</b> and <b>ODOURLESS</b>, so it has <b>NO DIRECT INFLUENCE</b> on the flame's color</li> </ul>
<p><b>EXHAUST GAS TEMPERATURE</b></p>	<ul style="list-style-type: none"> <li>● Exhaust gas is minimal when the combustion is optimum. ( When the energy is in the flame, not in the exhaust gas. )</li> <li>● Exhaust gas are warmer when the flame cools down (and turns orange).</li> </ul>
<p><b>CARBON MONOXYDE AND SOOT</b></p>	<ul style="list-style-type: none"> <li>● Produced in minimal quantity (non-harmful) when the combustion is at its peak or in air excess.</li> <li>● Produced in potentially hazardous quantity when the air intake is defective. The three main causes are these :                     <ol style="list-style-type: none"> <li>1- Dirt has been accumulated in the burner's orifices or in the burner's end cap slits.</li> <li>2- Empty propane tank or lack of pressure.</li> <li>3- Defective air input in the grow room.</li> </ol> </li> </ul>

**IMPORTANT NOTE ABOUT SOOT PRESENCE :**

WHEN SOOT ON THE BURNER OR AROUND IS PRESENT, IT MEANS THAT THERE IS AIR SHORTAGE AT THE BURNING STAGE AND THEREFORE, CARBON MONOXYDE EMANATION. On the other side, it is uncertain that there is soot deposit even though carbon monoxide is generated.

SOOT PRESENCE = CARBON MONOXIDE PRESENCE

CARBON MONOXYDE PRESENCE = POSSIBLE SOOT PRESENCE BUT UNCERTAIN