



GEN-1 CO₂ Generator

Custom Automated Products offers economical and safe carbon dioxide generators. They produce CO₂ by burning either propane or natural gas. We have designed our CO₂ generator to allow you to increase the CO₂ production by simply installing additional burners.

OVERVIEW

The GEN-1 can produce between 3-13 cubic feet of CO₂ per hour. It is recommended for areas under 3200 cubic feet.

Features a "two-stage" safety pilot valve, which will not allow fuel to flow to the burner unless the pilot is lit.

Our standard "tip-over" switch will shut down the fuel to the main burner in the event the unit falls or tips over.

The GEN-1 can be expanded by adding additional burners. Each burner adds approximately 3 cubic feet of CO₂ per hour.

Manufactured in the USA using only AGA and UL listed components.

INSTALLATION

- 1) Determine the desired location for the generator. It must be positioned at least 18" away from walls or other flammable materials. A distance of at least 18" must be maintained between the top of the unit and the ceiling or roof. Open flames are present inside the unit. Do not use the unit around flammable materials.
- 2) The unit must be hung from suitable supports. Use the hooks and chains that are included with the GEN-1 to secure the unit. The unit must be level in order to operate correctly and safely.
- 3) The hose that is supplied with the generator is fitted with a standard 3/8" female flare connection. Connect the gas hose to the back of the CO₂ generator. To connect the hose, use two wrenches in order to properly tighten the connection without twisting any internal connections.



****WARNING: Connecting propane to a generator meant to burn natural gas will result in dangerously large flames. Alternately if natural gas is connected to a generator meant to burn propane will result in inconsistent flames with too little fuel available to burn properly. Make sure the fuel supply matches your generator type!***

PROPANE GENERATORS ONLY

****NOTE: The GEN-1 propane model comes with a standard tank mounted regulator, which must be used unless the LP pressure is already regulated to 11" WC pressure at an outdoor propane tank.***

- 4) Connect the other end of the hose to the LP regulator supplied with the unit. To connect the hose, use two wrenches in order to properly tighten the connection.
- 5) Open the gas valve on the propane tank. Check for leaks on all connections using a spray bottle with soapy water. Look for bubbles, which would indicate a leak.

NATURAL GAS GENERATORS ONLY

****NOTE: It is critical to install the regulator supplied "in-line" between your gas supply and the generator. The regulator supplied with the GEN-1 is preset to maintain a constant pressure of 4.5" WC, which is around 1/4 PSI. It is important to verify the main gas pressure before installing the unit. Most gas utility companies install low-pressure gas regulators on the main gas line that are set up to 1/2 PSI, (4.5 - 7" WC). Some commercial buildings have a high-pressure gas main (usually 2 PSI). If this is this case, you will need to have the pressure reduced to 1/2 PSI or lower before installing the low-pressure regulator supplied with the unit.***

- 4) Make certain that you have a gas shut-off valve on your gas supply. Install the shut-off valve in an accessible location. Install the in-line regulator to the gas supply, (3/8" NPT female thread). Connect the hose to the in-line regulator. To connect the hose, use two wrenches in order to properly tighten the connection.
- 5) Open the gas valve on the gas line. Check for leaks on all connections using a spray bottle with soapy water. Look for bubbles, which would indicate a leak.

CO₂ CONTROLLERS

***NOTE:** The recommended CO₂ level for optimum growth is between 1000 to 1500 PPM. Above that is usually considered wasteful. Above 5000 PPM is considered dangerous to animals and humans. Side effects of excessive CO₂ include headaches and drowsiness. Use a PPM controller to ensure you are maintaining the proper PPM level.

- 1) Connect the CO₂ generator's power supply to the controller that you are using. Normally, the generator is used only during daylight hours. At the very least, a timer or photo-controller should be used to turn the generator on only during the day to eliminate waste.
- 2) If you are using a P.P.M. (Parts Per Million) controller, set the CO₂ level to the desired PPM and plug in the power supply of the CO₂ Generator into the controller.

LIGHTING THE PILOT FLAME

***NOTE:** The pilot flame must be lit in order for the main burner to receive fuel. Once the pilot flame is lit, it will not need to be re-lit unless the gas supply is interrupted.

- 1) Connect the power supply to the power connection on the side of the generator and plug it into the wall or your CO₂ controller.
- 2) Ensure the power switch on the side of the unit is OFF. Turn ON the gas supply to the unit.
- 3) Remove the front panel by loosening up the 4 screws on the front of the GEN-1. When loose, the front cover will lift off. You can then light the unit easily. Using a lighter, apply a flame to the tip of the pilot burner tube.
- 4) Press and hold down the red button on the pilot safety valve to allow gas flow to the pilot burner.

***NOTE:** If lighting the unit for the first time, it may take a couple of minutes or so for the gas to purge the hose.

- 5) When the gas reaches the tip of the pilot burner, the pilot will light up. Continue to hold down the red button for up to a minute until the thermocouple heats up. When it hot enough, the pilot will remain lit after releasing the red button.
- 6) Once the pilot flame is lit, turning the unit's power switch ON will activate the main burner valve, allowing the main burners to ignite.
- 7) The amber indicator light is on as long as the main burner is running.

***WARNING:** The outer enclosure gets hot while operating, especially at the top of the unit. Do not touch the generator until it is cool.

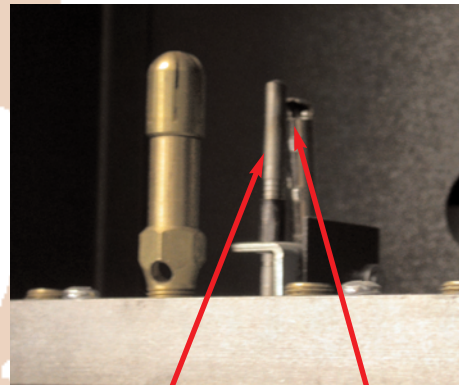
MAINTAINING YOUR GENERATOR

The GEN-1 has been designed for years of trouble-free service. The brass burners have been chosen over steel because of their superior performance over long periods of operation. The powder-coated enclosure can be cleaned with normal cleaners and will not "fade" over time. However, if for any reason the generator is not performing correctly, shut off the gas supply and turn the unit OFF. Simple problems can be remedied by consulting the troubleshooting guide within these instructions.

FRONT BURNER ACCESS PANEL

The unit must operate with all of the panels in place. However, the front panel can be removed when lighting or installing additional burners. Four screws are used to secure the panel in place. Simply loosen the screws and lift the panel off the "keyholes" in order to expose the burner assembly. Be sure to replace the cover prior to operating the GEN-1.

***WARNING:** There are no user serviceable parts inside this generator. Do not attempt to service the GEN-1 gas components.



Thermocouple

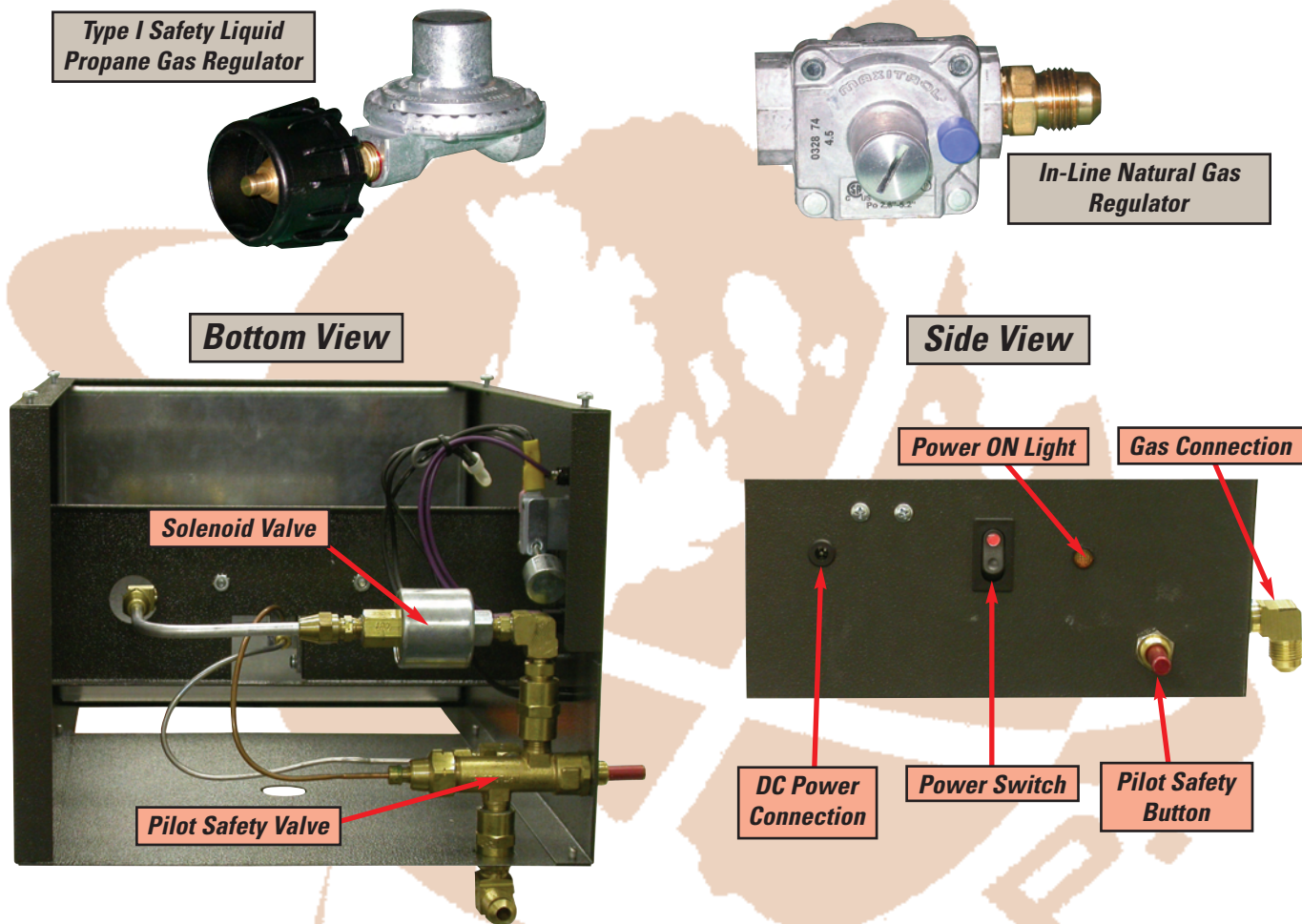
Pilot Burner Tube



SAFETY FEATURES

Your GEN-1 has been designed with safety in mind. There are several items worth mentioning.

- 1) Pilot safety valve: We use a dual-stage pilot safety valve, which ensures the pilot flame is present BEFORE allowing gas to flow to the main burner. Other manufacturers use single-stage valves which allow gas to flow to the main burner while lighting the pilot flame which could result in a dangerous "fume explosion" when lighting the pilot.
- 2) Tip-over shut-off switch: Gas and electric heater manufacturers are required to use a simple safety device in their units that shut off the unit in the event it tips over or falls. We have incorporated the same safety into the GEN-1. If the unit is tilted more than 35 degrees in any direction, the main valve is turned off preventing fuel flow to the main burner.
- 3) AGA approved devices: All of the gas components we use are appropriate for use with both LP and Natural gas. We use only the finest brass fittings and heavy-duty hoses. The GEN-1 comes with a low-pressure, in-line natural gas regulator or the new Type I style "no-tool-required" LP regulator to make tank replacement easy. The Type I LP tank connector incorporates a "flow-limiting" device that reduces flow to 10 SCFH in the event of a leak. The Type I also contains a heat sensing spring-loaded module, which stops gas flow if the temperature exceeds 240 degrees F.



OTHER FEATURES

We have tried to make your CO₂ generator as easy to use and attractive as possible. Some of the less noticed details of the GEN-1 include the following.

- 1) Powder-coated steel enclosure: The attractive steel enclosure has been powder-coated for a long lasting finish that will not fade or shift color with time. The enclosure itself has been engineered to allow the heat produced by the unit to dissipate and also to operate cooler than other competing generators.
- 2) Visual appearance: Keeping in mind the importance of the generator's function, we have located all of the key devices on the right side of the unit. A power rocker-switch has a red flag to indicate the unit is turned ON. An amber light glows when the main gas solenoid valve is open. The power supply quick-connect as well as the pilot safety valve manual override button is located in a very accessible location OUTSIDE the enclosure.
- 3) Easily serviceable: We have provided two access points (front and back) which allow the pilot light to be lit from outside the unit using an extended tip lighter, rather than having to remove the front cover in order to light the pilot light. In the event the unit must be serviced or burners are to be added, the entire front cover can be easily removed to expose all serviceable parts.
- 4) LP / NG conversions: Unlike other similar devices, the GEN-1 is very easy to convert from LP to Natural gas operation or vice-versa. A conversion kit is available that includes the replacement pilot orifice and a new identification label. Should the need arise to convert the unit, a screwdriver, a couple of wrenches and 5-10 minutes is all that is needed. Also, new burners must also be installed.

PROPER SIZING

It is important to consider that some manufacturers have inaccuracies within their generator ratings. In order to compare sizes, a very simple conversion can be used to determine a CO₂ generator's ACTUAL capacity to produce CO₂. That is assuming you know the actual Btu output of the unit. British thermal units (BTUs) are stated as the actual heat output of the unit. Heat output (BTU), is determined simply by knowing the pressure of the gas, the type of gas (LP or natural) and the volume of gas allowed to flow to the burner.

To convert an LP generator's Btu rating into cubic feet of CO₂ per hour:

$$\frac{\text{Btu / Hr} \times 1.18}{1000} \quad \text{Example: } \frac{11,176 \text{ Btu} \times 1.18}{1000} \quad \frac{11,176 \times 1.18 = 13,187}{1000} = \mathbf{13.2 \text{ cuft CO}_2 \text{ /hr}}$$

To convert a Natural Gas generator's Btu rating into cubic feet of CO₂ per hour:

$$\frac{\text{Btu / Hr}}{1000} \quad \text{Example: } \frac{12,540 \text{ Btu}}{1000} \quad \frac{12,540}{1000} = \mathbf{12.5 \text{ cuft CO}_2 \text{ /hr}}$$

So a CO₂ generator running propane, with a rating of 11,176 Btu will produce 13.2 cubic feet of CO₂ per hour assuming a standard pressure of 11"WP is used. A natural gas fired generator rated at 12,540 will produce up to 12.5 cuft / hr of CO₂ per hour. That's not the only thing to consider.

Before operating your CO₂ generator, make sure you have accounted for the heat it will be producing. The ratings in the specification section of this manual give you the Btu per hour rating. Keep in mind that if the CO₂ generator is only ON for 30 minutes each hour, the Btu / hr rating would be reduced by one half resulting in CO₂ outputs of 1/2 the capacity rating.

Determining what size unit and how long to allow the unit to run for is almost impossible due to the variables which different areas exhibit. Areas which are well sealed and have coordinated cooling devices can be easily maintained compared to areas which are not sealed or use a exhaust fan at all times.

ADDING BURNERS

The unique ability to increase the CO₂ production capacity of the GEN-1 by adding burners allows you to expand as necessary. Installing additional brass burners can increase the GEN-1's CO₂ producing capacity. Use only CAP burners. The brass burners CAP uses are customized specifically for CO₂ production. Each burner installed adds approximately 3 cubic feet of CO₂ per hour.

***NOTE: People operating the GEN-1 at altitudes higher than 3000 ft above sea level may need to use slightly smaller burners to reduce fuel flow due to lower levels of oxygen available. If the flames appear yellowish or too large, please contact your dealer or CAP for special burners which are designed to operate at higher altitudes.**

STORING YOUR GENERATOR

If you are not going to be using your CO₂ generator for an extended period of time, you need to keep it in a dust and insect free area. We suggest that you put the generator and all components into a sealed bag (like a garbage bag), to prevent debris from accumulating inside of the gas train, especially the slotted cap burners.

CONTROLLER OPTIONS

CAP offers a full line of CO₂ controllers from simple to sophisticated. Controllers such as the CO₂-2 or CO₂-4 controllers intelligently coordinate your exhaust fans with the GEN-1. They also have built-in recycling timers and an optional Part-Per-Million upgrade. The simple and economical PPM-3 is designed specifically for people who want Part-Per-Million accuracy from their generator.

Some people believe that because a generator is so much cheaper to operate than compressed CO₂ systems, they will not need a CO₂ controller to regulate the CO₂ level inside their area. This is incorrect. CO₂ generators produce quite a bit of heat and water vapor, which must be considered during your setup. Remember that the longer the CO₂ generator runs, the more heat you are producing. In some cases the extra heat is not a problem, but for some setups, it is almost imperative to use some type of controller that turns on the generator only when the CO₂ level is below the desired level. Using a timer to control the generator can be done with some success but you may end up quite a bit above or even worse quite a bit below your intended CO₂ level.



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**The
Perfect
Combination!**

TROUBLESHOOTING

If you are having problems with this unit, refer to these troubleshooting hints.

<i>Problem</i>	<i>Suggested Action</i>
<i>The pilot flame will not stay lit.</i>	<p>The red button must be held in for as much as 1-2 minutes while lighting the pilot flame.</p> <p>If the pilot lights but then goes out during operation, check your gas supply / LP tank.</p> <p>Visually verify the pilot flame is contacting the thermocouple tip. If the thermocouple does not get hot enough, the pilot burner safety valve will not open. If the flame is contacting the tip and the burner still will not light, you may have a bad thermocouple.</p>
<i>The burner flames are not consistently burning.</i>	<p>Verify the unit matches the type of gas you are supplying and the gas pressure is correct.</p> <p>After extended use, the small holes (orifice) in the burners may become clogged or dirty. The burners should be serviced by a qualified gas serviceman or return it to us for service.</p>
<i>The generator is being used with a PPM sensor and the generator never seems to turn off</i>	<p>Your area is leaking out CO₂ faster than the generator can produce it. Try sealing the area better, coordinate the cooling exhaust fans with the generator (an AIR-3 can be used to coordinate ventilation cycles), or possibly add burners to the generator until the level maintains properly.</p> <p>If you are using a PPM controller, make sure that it is set between 1000 and 1500 ppm. Trying to raise the level above 1500 ppm is wasteful and potentially dangerous.</p>
<i>The unit is plugged in and turned on but the amber light and burner don't work.</i>	<p>Verify the power switch is ON and the power supply is getting power. Make sure the unit is level. Check the tilt switch in the right rear corner of the enclosure. It has a small pendulum weight that must be hanging vertically in order for the generator to operate.</p>
<i>The flames on the main burner seem either too large with yellow flames or too small "flashing" ON and OFF.</i>	<p>You may have mixed burners. Verify you are using natural gas burners with natural gas and propane burners with propane.</p> <p>Lazy yellow flames indicate low gas flow due to low propane tank level or low natural gas pressure. Long piping runs with natural gas need to be appropriately sized.</p> <p>At extremely high altitudes, it may be necessary to use customized burners. Contact the your store or manufacturer for details.</p> <p>Verify the unit matches the type of gas you are supplying and the gas pressure is correct.</p>

PRECAUTIONS

- After making the gas connections ALWAYS check for leaks using soapy water and a spray bottle.***
- This unit is NOT for residential use. The exterior of the unit can get very HOT when in operation.***
- Always wait for the generator to properly cool down prior to servicing the unit or removing the front panel.***
- DO NOT allow the CO₂ level to rise above 2500 ppm. Operate only in safe ventilated environments.***
- DO NOT operate the unit if gas or other flammable fumes are noticed.***
- DO NOT operate this unit with the front access panel removed.***
- The GEN-1 SHOULD be connected to a suitable CO₂ controller to regulate the CO₂ level.***
- If operating the unit in an area with limited ventilation, an inexpensive carbon monoxide alarm is recommended.***

WARRANTY

The GEN-1 is warranted against defects in workmanship and parts for Three Years.

SPECIFICATIONS

Power Supply In:	120 volts	Power Supply Out:	18-24 volts DC
Propane Pressure:	11" WC	Natural Gas Pressure:	4.5" WC
Total BTU 1 Burner	Propane 2,794 / Natural Gas 3,135	Total BTU 2 Burners	Propane 5,588 / Natural Gas 6,270
Total BTU 3 Burners	Propane 8,382 / Natural Gas 9,405	Total BTU 4 Burners	Propane 11,178 / Natural Gas 12,540
Weight	12 lbs	Dimensions	11" x 16.5" x 8.5"

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