

Specifications

Amps / Volts requirements	400 ma @ 24 VDC
Propane pressure (VGC-27LP)	11" WC / 2.8 kpa
Natural Gas pressure (VGC-27NG)	4.5" WC / 1.15 kpa
Cu ft per hour / CO2	6-27 SCFH
BTU Rating (Variable)	LP 4,526 - 22,630
	NG 5,534 - 27,670
VariableCO2 Modes	2 - 5 - 7 - 10 burners
Weight / Dimensions	22 lbs / 17.7" x 15" x 10"
Life Expectancy	> 10 years



Sentinel CO2
Generators offer a
3-year warranty.

Ask your retailer for
details.

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SENTINEL

Instruction Manual

VCG-27

Variable CO₂ Generator

SENTINEL



Introduction

Carbon Dioxide / CO₂ is critical for all plants. Normal atmospheric air around the world averages about 380 Parts-Per-Million (PPM.) When plants are provided higher levels of carbon dioxide, they can grow faster and larger. It is normally agreed by experts that up to 1500 PPM is beneficial to plants and the best way to increase the CO₂ level is by using a CO₂ generator that burns either natural gas or propane.

The VCG-27 has two models, the LP (propane) and an NG (Natural Gas) model. Both come complete with (10) clean burning brass burners pre-installed and the appropriate regulator & hose.

The VCG-27 CO₂ generator is the most advanced CO₂ generator available today.

- 1) The VCG-27 has a **variable output** from 6 to 27 cubic ft of CO₂ per hour.
- 2) It has an electronic ignition control module that eliminates the open pilot flame for safer operation.
- 3) The 10 brass burners have been designed to burn cleaner and produce a **consistent blue flame**.
- 4) The **tip-over switch** automatically shuts off the entire unit in the event the unit falls or tips over.

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Problem: Some of the burners seem to be not burning correctly.
Make sure that the burner control valves are either fully ON or fully OFF. Make sure the gas supply is adequate and the gas hose is not kinked or twisted.

Problem: The growing area is getting too hot and / or humid.
Decrease the number of burners that are operating. Refer to the Burner control valve explanation on page #8.

Problem: The CO₂ level does not seem to be increasing enough.
Increase the number of burners that are operating. Refer to the Burner control valve explanation on page #8.

Problem: I hear the unit buzzing and sparking.

The unit will attempt to fire the burners 5 times for 5 seconds each. During that time, you will hear a “sparking” sound. This is normal. It is not normal for the unit to fail to light after 3 tries. Check the gas supply / LP tank. If the gas supply tests OK, consult the factory.

Red Lock Out LED is blinking On & Off

The Lock Out function is automatic and will be activated if 5 attempts to light the pilot are not successful. Normally, it will mean the propane has run out or the gas supply has been interrupted. Once the problem is determined and fixed, cycling the power switch Off and then On will reset the error.

*** High-altitude operation:** The burners on the VGC-27 have been selected to operate correctly from sea-level up to 4500ft elevation. If you are at high altitude (4500+) and notice yellow flames, contact the factory. Special high-altitude burners are available.

Troubleshooting

Some of the more common questions and problems are listed here.

Consult the factory for other concerns not listed.

Problem: There is a gas smell in the area.

Shut off the gas supply immediately. Do not turn ON any electrical devices and ventilate the area by opening vent, doors or windows. Exit until the gas smell is not evident.

After ventilating, determine where the gas is leaking from by using a spray bottle with soapy water in it. Spray all gas connection with the water and look for small bubbles. Seal any leaks. If the problem persists, consult the factory.

Problem: The unit is trying but the burners are not lighting.

When the unit is first started or a LP tank is replaced, the gas lines make take some time to fill with gas. The unit will attempt to fire the burners 5 times for 5 seconds each. Each attempt is followed by a 20 second “purge” time. After three tries, the unit is locked out. Determine why gas is not getting to the unit. To reset the unit, cycle power OFF and then back ON.

Problem: The power is connected, but the Green indicator is not on.

The “tip-over” switch may be activated. Tilt the unit to one side and listen for a clicking noise. The switch is like a pendulum and will shut off the burner if the unit is not operated level.

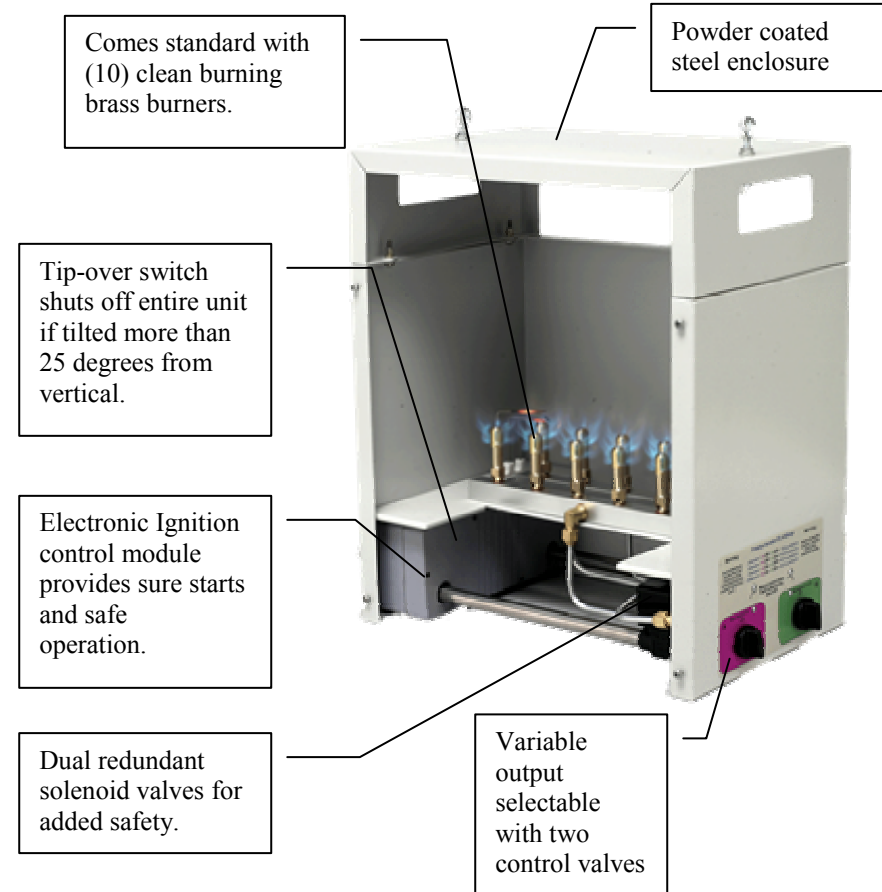
Problem: The flames appear to be too large or yellow.

Verify you are using the correct fuel, (LP or NG). The supplied regulator must be installed or high pressure may increase the flames to dangerous heights. Check the regulator. **DO NOT operate the unit with yellow or large flames.** Consult the factory.

Problem: Some of the flames appear to be blue but small in size or “lazy”. The flames should resemble a flower when operating correctly.

Verify the manual burner control valves are either in the ON or OFF position. If the valves are set in the middle, improper operation will result. Check the regulator and gas supply, low pressure/ low LP tank level will also cause this condition to occur. **DO NOT operate the unit with lazy blue flames.** Consult the factory.

A quick look at the VCG-27...



Regulator supplied with Natural Gas Generators



Regulator supplied with Propane Generators



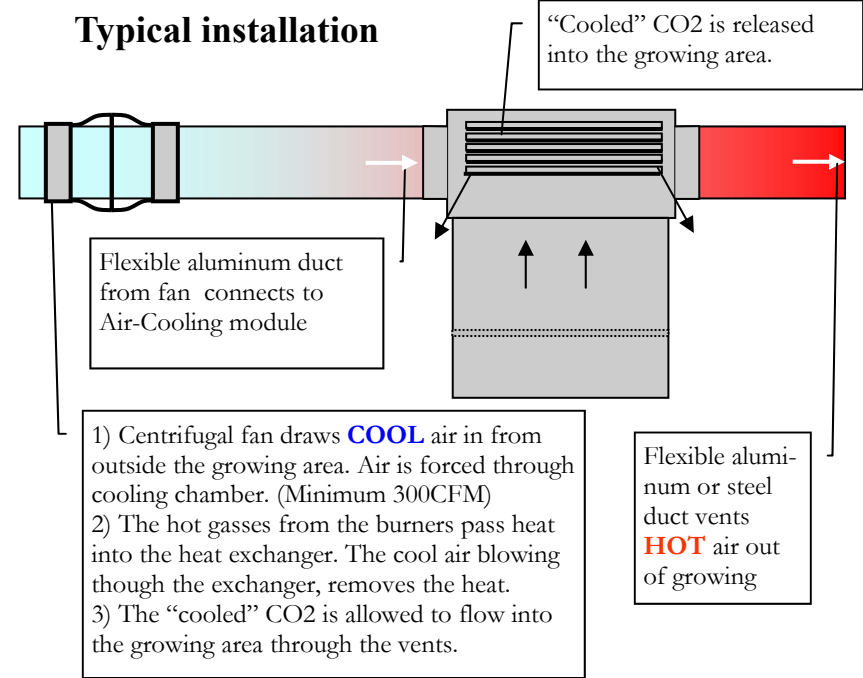
NOTE: The ignition control module produces a spark from a pair of electrodes near the tip of one of the brass burners to ignite the gas. Do not attempt to service the sparking electrode or place foreign objects anywhere near the electrodes.

Installing the VCG-27

NOTE: In order to ensure a safe and proper installation, follow the steps below. Be aware that in closed spaces without ventilation, toxic levels (above 5000 PPM) of CO₂ can accumulate. Do not allow the unit to operate without the proper controls or timers.

- 1) The unit is designed to hang from a ceiling joist or overhead support. It comes with two eyebolts, hooks and sections of chain.
- 2) **DO NOT** place the unit on top of something like a table to operate it. The generator **requires a free flow of air** coming in through the bottom of the enclosure.
- 3) The chains provided are 18" long. A minimum of 18" must be maintained between the unit and any walls or other obstructions.
- 4) Install the two screw hooks into a suitable supports. The chains are then secured to the unit and the screw hooks with the included S hooks. Bend the S hooks so that they cannot slip from the chain and the hanging hooks. Ensure that the unit is hanging level.
- 5) The gas connections must be tightened properly. The supplied 12 foot hose is connected from the flare fitting on the CO₂ generator to the provided gas regulator. Secure the connection with two wrenches.
- 6) Once the gas connections are secured, pressurize the gas line and check for leaks using the soapy water. Spray the water onto the gas connection fittings and look for any bubbles. Re-secure if necessary.
- 7) The VCG-27 operates on 24 volts DC. The power supply included with the unit is connected to a controller or timer that will determine how long / often the unit will operate. Connect the power supply jack to the unit and the desired controller or timer.
- 8) The main power switch on the side of the unit will activate the ignition module and firing sequence. When the **RED** indicator light is illuminated, the unit is powered and operating.

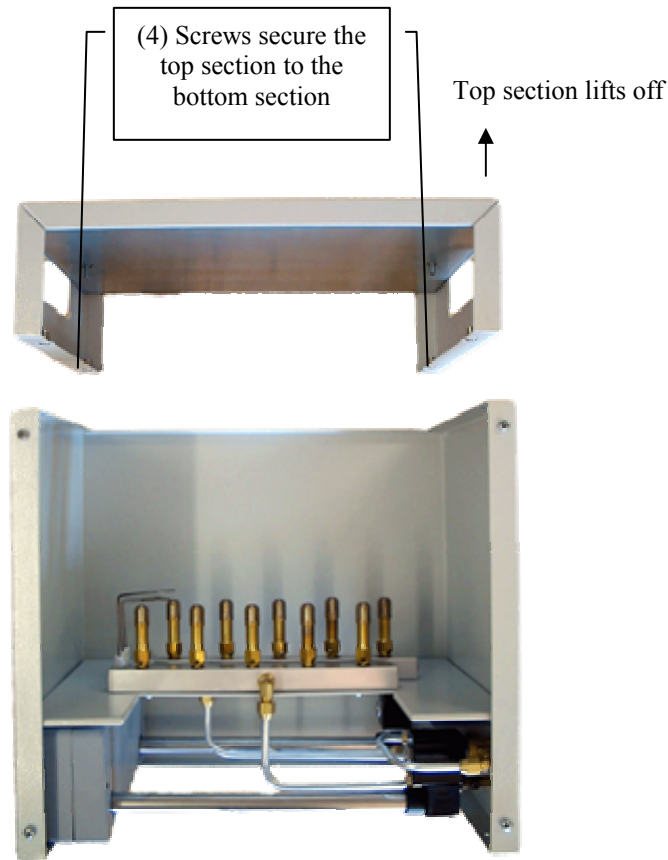
NOTE: When you are ready to start the unit for the first time, refer to the "Starting the unit for the first time" section of this manual.



- 1) Disconnect power to the VCG-27 generator & shut off the gas line.
- 2) Lower the unit from the hanging point and set it on top of a stable surface.
- 3) Loosen the (4) screws and remove the front access cover.
- 4) Loosen and remove the (4) screws that secure the top of the VCG-27 to the bottom section. The 2 sections can now be separated.
- 5) Place the VCG-COOL on top of the VCG-27 and align the (4) screws. Slip the VCG-COOL into place and tighten the (4) screws.
- 6) Replace the access cover and tighten the (4) screws.
- 7) Re-hang the unit and ensure all screws are tightened.
- 8) Install the circulating fan. The fan inlet needs to draw air from outside the growing area. The outlet of the fan gets connected to one side of the VCG-COOL using metal **NON FLAMABLE** metal ducting.
- 9) The other side of the VCG-COOL is connected to another piece of metal **NON FLAMABLE** ducting. The ducting is then routed so that the hot air is exhausted out of the growing area.
- 10) The fan must be connected to be turned ON when the VCG-27 is operating.

NOTE: Incorrect installation of the VGC-COOL could damage the fan connected to it. Make sure the fan pushes air through the VGC-COOL.

Optional Air-cooling module VCG-COOL



Once the top section is removed from the bottom section, the VGC-COOL (not shown) can be installed on top of the unit.

NOTE: Make sure all (4) screws are securely tightened after installing the VGC-COOL.

VCG-27 Propane & Natural Gas

NOTE: The VCG-27 **MUST** be used on the appropriate gas supply and **MUST** be used with the supplied gas regulator.

There are two different VCG-27 units, one is used for Propane (VCG-27LP) and one is used for Natural Gas (VCG-27NG). Below is the differences between the two units. Make sure you have selected the correct unit and are using the matching gas.

VCG-27LP / Propane: Liquid Propane otherwise known as LP or Propane is stored in pressurized tanks of varying sizes. The gas exiting the pressurized tank **must** first be regulated to a very low pressure before it enters the gas burners. The standard for measuring the low pressure is inches of water column or " WC. The VCG-27LP operates at 11" WC or about 1/2 PSI. Once the gas is regulated down to the correct pressure, it enters the unit and flows through the brass burners. Each brass burner has been designed to produce approximately 3 cu ft of CO₂ per hour. Each LP burner will also produce 2263 BTU of heat and quite a lot of water vapor along with the 3 cu ft of carbon dioxide. The Propane regulator provided with the unit **MUST** be used unless it is verified that the propane gas supply is already regulated to 11" WC.

The provided LP regulator is designed to connect directly to portable LP tanks. It also has a built-in safety function that limits the flow of gas to a very low level in the event of a large gas leak.

Any questions...Consult a licensed installer or contact the factory.

VCG-27NG / Natural Gas: Natural Gas otherwise known as NG is piped directly into homes and businesses from an extensive pipeline system. The gas supply entering the building can vary from very low pressure (less than 1/4 PSI) to over 5 PSI. The natural gas provided to the VCG-27NG **must** first be regulated to a very low pressure before it enters the gas burners. The standard for measuring the low pressure is inches of water column or INCH /WC. The VCG-27NG operates at 4.5" WC or about 1/4 PSI. Once the gas is regulated down to the correct pressure, it enters the unit and flows through the brass burners. Each brass burner has been designed to produce approximately 3 cu ft of CO₂ per hour. Each NG burner will also produce 2767 BTU of heat and quite a lot of water vapor along with the 3 cu ft of carbon dioxide. The NG regulator provided with the unit **MUST** be used unless it is verified that the natural gas supply is already regulated to 4.5" WC.

Any questions...Consult a licensed installer or contact the factory.

Starting the unit for the first time

Here is a quick checklist and suggested start-up procedure.

- 1) Follow the installation instructions on page 4 of this manual. Once installed go to step #2.
- 2) Look inside the unit and verify there is no loose packing material or other foreign objects. Look at the gas connections and verify nothing appears damaged or out of place.
- 3) Make sure the power switch is turned OFF.
- 4) Pressurize the gas lines by opening any shut-off valves on the gas supply. Double check for leaks if this is the first time the unit will be used. Gas leaks can be extremely dangerous.
- 5) Once the gas supply has been pressurized and tested for leaks, verify there is no objects within 18” of the surface of the unit.
- 6) Turn both burner selection control knobs to the OFF position. Initially, we will test just two burners. After the lowest setting is tested, the two control valves can be opened.
- 7) Plug in the 24 volt DC power supply to a 120 volt power source. Connect the small cable to the power inlet jack of the unit.
- 8) Turn the power switch ON, the **Green** indicator light should turn ON. After a short pause, the ignition module will attempt to ignite the burners for 5 seconds. If the unit fires, go to step #9. If this is the first time the unit was used or if the LP tank was recently replaced, it may not successfully start after the first attempt. After a 20-second delay, the unit will attempt to re-fire for 5 seconds. If after five (5) attempt to fire the burners is unsuccessful, the module will lock itself until power to the unit is recycled OFF & ON. (See troubleshooting)
- 9) Once the burners fire, look from under the unit and verify the flame is blue and consistent.

NOTE: If the flame appears yellow or excessively large, shut the unit off and refer to the troubleshooting section of the manual. The flames should appear blue and resemble a small 6-pointed star.

- 10) Once the first two burners are tested, open the two burner selection valves one at a time and visually verify the burners also look OK.
- 11) Open both burner control valves and test all of the burners operating together. If the unit will be operated in the maximum configuration, ensure no materials around the unit are getting hot. The VCG-27 produces up to 27,000 BTUs of heat at full capacity so be sure the heat will not become too great for the area or the surroundings.
- 12) Once tested at full capacity, set the control valves at the desired setting and connect the unit to your controller or timer.

Optional Air-cooling module VCG-COOL

Like any other CO2 generator, the VCG-27 can produce a lot of unwanted heat... up to 27,000 BTU. There is no way to effectively remove ALL of the heat, while keeping the CO2 in the growing area. BUT, there is a way to remove up to 6,600 BTU of heat, by using the optional VCG-COOL Air-Cooling module. Unlike other less effective attempts to remove heat from CO2 generators, the VCG-COOL module has been designed to absorb as much heat as possible while leaving the cooled CO2 in the growing area.

Up to an 8” centrifugal fan is connected to one end of the cooling module using fireproof flexible aluminum or steel ducting. The fan forces cool air from outside the growing area into the cooling chamber. Since the cooling chamber is **sealed**, no outside air is allowed to enter the growing area and no inside CO2 is allowed to pass through the unit to the outside. The outlet from the cooling module is connected to another length of flexible aluminum duct and the hot air is exhausted outside of the area. (Recommend using an 6-8” fan with 300-700 CFM)

The total amount of heat that can be removed varies with the total amount of heat the generator is producing. See the chart below.

# of burners	BTUs of Heat Produced	Amount of heat removed (BTU)	Amount of heat remaining (BTU)
2	LP 4,523 NG 5,534	Up to 3000	LP 1,523 NG 2,534
5	LP 11,315 NG 13,835	Up to 4200	LP 7,115 NG 9,635
7	LP 15,841 NG 19,369	Up to 5400	LP 10,441 NG 13,969
10	LP 22,630 NG 27,670	Up to 6600	LP 16,030 NG 21,070

Removing heat from the area will reduce the stress on the plants and also reduce the amount of cooling required. See the connection example and installation procedure for the Air- Cooling module on the next page.

NOTE: Because of high temperatures... DO NOT use mylar, polyester or other flammable flexible ducting with the Air-Cooling module. Use only flexible aluminum or sheet metal ducting.

Connection Examples

Good



Use a timer like the DRT-1 to turn the CO2 generator On and Off and



Better



Use a Part-per-million CO2 controller like the CTC-1. Measuring the exact amount of CO2 in PPM, provides the most accurate method of control.

A CO2 generator is the most cost-effective method of adding CO2 to an area. You must also consider what type of controller will turn the CO2 generator On and Off to avoid creating too much CO2 and heat. CO2 can be measured by special sensors that measure CO2 levels in Part-Per-Million or PPM.

CO2 above 2500 PPM will make you feel uncomfortable and may cause headaches and other problems. CO2 levels above 500 PPM can be fatal so it is important to control the amount of CO2 being created by the VGC-27.

Normally 1200 to 1500 PPM is considered correct for rapid growth of plants, above that level is a waste. To properly control CO2 levels, nothing is better than a CO2 PPM controller like the CTC-1. It automatically measures the amount of CO2 in the area and activates the VGC-27 only when required.

NOTE: Do not operate the VGC-27 or any other CO2 generator without proper controls or timers. Do not operate the VGC-27 in closed spaces with inadequate ventilation.

Variable output and area sizes

One of the best features of the VGC-27 is the variable CO2 output. The user can select up to four different CO2 settings depending on their *“individual”* requirements.

Both the Propane (LP) and Natural Gas (NG) burners have been designed to produce about 3 cu ft of CO2 per hour each. LP has a higher fuel value than NG so each LP burner produces 2263 BTUs of heat while the NG burners produce 2767 BTUs of heat to create 3 cu ft of CO2.

Determine your area's cubic feet by multiplying height x width x depth and then refer at the recommended burner setting.

# of burners	Cu Ft of CO2 / hr	BTUs of Heat	Recommended Area size (Cu Ft)
2	LP 5.3	LP 4,523	0 - 2,000
	NG 5.5	NG 5,534	
5	LP 13.4	LP 11,315	2,000 - 5,000
	NG 13.8	NG 13,835	
7	LP 18.7	LP 15,841	5,000 - 7,000
	NG 19.4	NG 19,369	
10	LP 26.7	LP 22,630	7,000 - 10,000
	NG 27.7	NG 27,670	

NOTE: Each area is different, this is only a basic recommendation

The most common recommendation for PPM levels for rapid plant growth is between 1000 and 1500 PPM. The plants will benefit most by maintaining the CO2 level within this range during the daylight hours. By setting the burner control valves to activate more burners, CO2 will be produced quicker and will increase the CO2 level faster. However, along with CO2 production, heat will also be added to the growing area faster. Make sure your cooling system can handle the increased heat load before operating the unit at a high output level.

Operating the unit with only the two standard burners activated (both valves closed) will only add 1/5 of the heat as the unit would produce if both valves were opened. It is best to operate the unit at as low a setting as possible to maintain the CO2 level without adding too much heat.

Whenever possible, use a CO2 PPM controller or other appropriate controller to maintain an accurate CO2 level.

Burner control valves

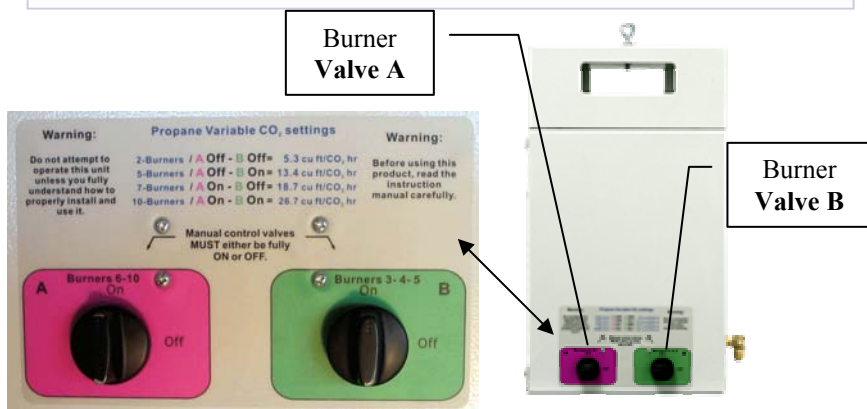
The magic behind the Variable CO₂ of the VCG-27 is (2) burner control valves that provide gas only to the burners that are selected. The aluminum gas manifolds and brass burners inside the generator are connected to the selection valves. When the valve is opened, gas is allowed to flow to the burners connected to the valve.

Valve A is connected to 5 burners and Valve B is connected to 3 burners. Activating the valves in up to four combinations provide the variable CO₂ output of either 2, 3, 7 or 10 burners.

The burner control valves are located on the end of the unit and are labeled A & B. The chart below indicates how to set the valves depending on how many burners you want to operate. Remember, more burners activated = more CO₂ & more heat produced. With both valves turned OFF, there are 2 standard burners that will receive gas. **Two burners is the lowest possible setting.**

Valve A Burners 6- 10	Valve B Burners 3-4-5	Burners operating	Cu Ft CO ₂ /hr (LP / NG)
OFF / closed	OFF / closed	2	5.3 / 5.5
OFF / closed	ON / opened	5	13.4 / 13.8
ON / opened	OFF / closed	7	18.7 / 19.4
ON / opened	ON / opened	10	26.7 / 27.7

NOTE: Make sure the burner control valves are either fully opened or fully closed during operation. DO NOT operate the unit with the burner control valves partially open.



Ignition control module

The VGC-27 uses the newest and most advanced ignition controller available today. The module provides the spark to light the (2) pilot burners, and then allows the main burners to ignite **only after the flame has been verified**. This provides consistent & controlled starts. If the module senses the flame is not present, it shuts off the solenoid valves.

One feature that is also worth mentioning is the “dual-redundant” solenoid valves that are controlled by the ignition controller.

The ignition controller has (4) LED indicators to verify correct operation.



Power On (Green LED) Indicates 24 volt power is supplied to the unit.
Lock Out (Red LED) The Lock Out LED blinking indicates the ignition controller shut off the solenoid valves and the unit is locked out. Cycling the power switch Off & On will reset the error. (See troubleshooting for more info)
Main Valve (Green LED) Indicates the ignition controller has activated the main solenoid and the unit is in operation.
Pilot Valve (Yellow LED) When the power is switched On, the ignition controller will provide a spark for 5 seconds, During that time, the pilot solenoid is activated. The Pilot Valve LED indicates that the pilot solenoid has been activated. (Should be On during operation)