

Generator (CO₂) Carbon Dioxide



DO NOT USE TEFLON TAPE

CD-Generator Operating Manual Installation and

Introduction

Carbon Dioxide Enrichment will dramatically increase the growth of green plants. Green plants use carbon dioxide (CO₂) and water in the presence of light to synthesize organic compounds. The plant then converts these organic compounds into elements that it can use (food). This process is called photosynthesis. If any of these ingredients (CO₂, water or light) are at levels below what the plant can use for maximum efficiency, it will only be able to perform at that level and no greater. Adding carbon dioxide to a growing environment that is not receiving proper nutrients or is low on light will not produce the desired results. Similarly, plants that are receiving plenty of sunshine and nutrients will only perform as well as the level of CO₂ will allow. The ambient level of CO₂ in the earth's atmosphere is generally between 300 and 400 ppm. Most plants receive far more water and energy in the form of sunshine than they can use. Increasing the CO₂ in the growing area will let the plant use the excess water and energy that is stored in the leaves. The result is a substantial increase in the growth rate of any plant that uses chlorophyll in the process of photosynthesis. Enrichment should commence at sunrise or when photoperiod begins and refrain during darkness hours. The average CO₂ level that is recommended is 1000 to 2000 parts per million (PPM). The object is to maintain a constant level in the atmosphere. You can run a small unit continuously during photoperiods or you can use a larger unit and time it to function periodically. Where exhaust requirements are frequent, the latter method is preferable. After the exhaust function the generator can be cycled to replenish CO₂ quickly to maintain rapid plant photosynthesis. Use the operation time charts to determine the size of generator and the number of minutes of operation required for the level of CO₂ desired. Frequency of recharge depends on the rate of consumption. For the greatest fuel economy and accuracy of recharge it is recommended that the Green Air Products CO₂ Monitor Controller (CDMC) be used with all generator and emitter systems.

Principals of Operation

Carbon dioxide generators operate by burning carbonaceous fuels such as propane or natural gas. The burners used in Green Air Products CO₂ generators are specially designed to maximize the production of CO₂ and minimize heat as a by-product. Green Air Products generators provide CO₂ far more economically than any other means of enrichment. A constant burning pilot is used to ignite the gas when the generator is turned on. A thermocouple is used to monitor the pilot flame. If the pilot flame is lost, a safety valve will close so that unburned fuel will not be released into the enclosure. CO₂ generator operations may be automatically functioned according to actual ambient values when installed in conjunction with a CDMC controller. This control device continually samples the level of carbon dioxide in the growing area and functions the generator whenever CO₂ levels do not meet your predetermined values. Generators are easily installed, dependable and efficient. Transformer included. Operates on 110VAC.

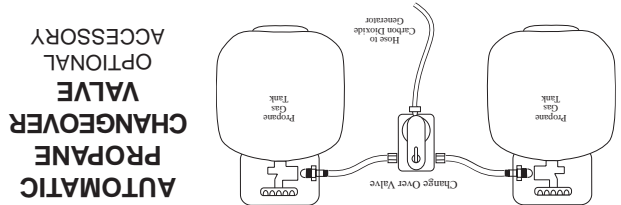
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Green Air Products guarantees that this equipment will perform as implied for the purpose it is intended. Green Air Products warrants the original purchaser of this equipment against defects in mechanical parts and workmanship for 2 years and electrical parts for 90 days. At our option we will repair or replace defective equipment. Warranty service is only performed at the factory or authorized service center. Any usage contrary to proper application or alterations of original construction will void warranty obligations. For further warranty information contact your dealer or Green Air Products service department.

For professional use by qualified personnel in a facility suited for proper operation in compliance with local, state and federal laws
TWO YEAR LIMITED WARRANTY

| Specifications | | | | | | | | | | |
|--------------------------------|------|------------------|-------|-------|------|-------|-------|-------|-------|-------|
| CO ₂ Output | | Fuel Consumption | | | | | | | | |
| CD-3 | CD-6 | CD-12 | CD-18 | CD-36 | LP | NG | LP | NG | LP | NG |
| 3.2 | 3.4 | 6.2 | 6.4 | 12.4 | 12.8 | 18.6 | 19.2 | 37.2 | 38.4 | 38.4 |
| .376 | .388 | .753 | .776 | 1.51 | 1.56 | 2.27 | 2.33 | 4.54 | 4.66 | 4.66 |
| 2183 | 2172 | 4366 | 4343 | 8733 | 8686 | 13098 | 13029 | 26196 | 26058 | 26058 |
| 1.03 | 2.01 | 2.05 | 4.02 | 4.1 | 8.04 | 6.15 | 10.06 | 12.3 | 20.12 | 20.12 |
| Transformer 110/12VDC 1Amp Max | | | | | | | | | | |



| CO ₂ GENERATOR FUEL CONSUMPTION CHART | | | | | | | | | | |
|--|-------------------|-----|-----|--------------------|---------------------------------|--|--|--|--|--|
| MODEL | PROpane TANK SIZE | | | MAX. CU.FT. BTU/HR | MAX. CU.FT. CO ₂ /HR | | | | | |
| | 1 | 5 | 10 | | | | | | | |
| CD-3 | 3.6 | 180 | 360 | 900 | 2183 | | | | | |
| CD-6 | 2 | 18 | 90 | 450 | 436 | | | | | |
| CD-12 | 4 | 12 | 60 | 300 | 8732 | | | | | |
| CD-18 | 6 | 6 | 30 | 150 | 1310 | | | | | |
| CD-36 | 12 | 3 | 15 | 30 | 262 | | | | | |

This chart is used to decide how long a tank of propane will last. This chart is fairly self explanatory first you will look in the left column to pick a model, then follow it across to the propane tank size you have. The number that corresponds with the two selections will be the number of hours that you can operate the CO₂ generator.

Rules For Safe Operation

**** IMPORTANT ****

- Read and understand the information in this manual before operating the equipment. Observe all CAUTIONS.
- Unit should be operated in a safe, clean and ventilated area free of flammable materials.
- Housing becomes hot under normal operating conditions. To avoid possible burns, never touch equipment during operation.
- To service or repair this unit always disconnect power source and shut off fuel supply.
- Do not operate if gas fumes are noticed. It is recommended the fuel tank be located outdoors or in a well ventilated area free of sparks or open flame.
- For service or repair always send the unit back to the factory or an authorized service center.

Never overfill propane tank. Allow room for expansion of contents due to contrast in temperatures. It is recommended that tank be located outside the enclosure for safest operation. A properly burning flame should burn clean and blue and produce no toxic emissions. Remember a flame requires oxygen to burn so adequate fresh air intake and circulation is important. Always check for leaks after refitting.

Size and Timing Chart

| 1000 PPM | | | | | | | | | | | |
|----------|------|------|------|-------|-------|-------|-------|-------|-------|-------|-------|
| CU/FT | 100 | 200 | 400 | 600 | 800 | 1000 | 1200 | 1400 | 1600 | 1800 | 2000 |
| CD-3 | 2.00 | 4.00 | 8.00 | 12.00 | 16.00 | 20.00 | 24.00 | 28.00 | 32.00 | 36.00 | 40.00 |
| CD-6 | 1.00 | 2.00 | 4.00 | 6.00 | 8.00 | 10.00 | 12.00 | 14.00 | 16.00 | 18.00 | 20.00 |
| CD-12 | .50 | 1.00 | 2.00 | 3.00 | 4.00 | 5.00 | 6.00 | 7.00 | 8.00 | 9.00 | 10.00 |
| CD-18 | .33 | 0.66 | 1.33 | 2.00 | 2.66 | 3.30 | 4.00 | 4.66 | 5.33 | 6.00 | 6.60 |
| CD-36 | .17 | 0.33 | 0.66 | 1.00 | 1.33 | 1.66 | 2.00 | 2.33 | 2.66 | 3.00 | 3.30 |

This chart will give you the minutes of operation required for the areas and models shown. Top row of the chart represents cubic feet of area in the enclosure (LxWxH). The left column is the model size. Model numbers represent maximum CO₂ output per hour in cubic feet (CD-3 = 3 cuft/hr CO₂). **Example:** A CD-6 will take 10 minutes to produce a CO₂ level of 1000 ppm in a 1000 cu. ft. enclosure. The area should be charged as quickly as possible for maximum advantage. Charging the atmosphere quickly insures that the rapid photosynthesis process will not be interrupted and the plants growth rate reduced. Five to ten minutes is a good charge time. Try not to exceed twenty minutes. Your microclimate will need to be recharged every 1 to 4 hours depending on how much CO₂ is lost due to plant usage or drafts (leaks). Large greenhouses logically require longer charge times and multiple units may be necessary. The CD-36 takes 1.66 minutes per 1000 cu.ft. area to charge to 1000 ppm. Therefore a 20,000 cu. ft. area would be 20 X 1.66 which is 33.2 minutes. For this application that may be an acceptable charge time.

Generator Installation

WALL MOUNT

Bracket wall mount screw holes must be 10 inches center to center. Mount brackets to wall and housing will slip over screw heads and fit snug into slotted holes in housing back. This allows for easy removal of housing from wall brackets. Make certain bracket screws are secure in wall and use good judgement when choosing mounting location.

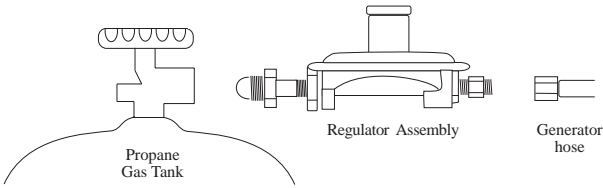
SUSPENDED

Use chain, eyebolts and ceiling hooks found in hardware pack. Hang unit from sturdy location at least 18 inches from ceiling. The unit must operate in level upright position. "CAUTION" Should unit fall during operation fire may result.

FREE STANDING

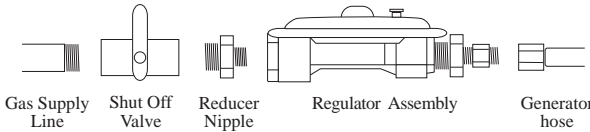
Remove the four screws holding the bottom plate to the housing. Locate the holes on the bracket to match and replace the screws.

Propane Hook-up



1. For propane applications use a propane tank that has been filled to only 80% of its capacity. This is very important for all propane burning mechanisms. Failure to observe this common rule will make your generator hard to ignite and will not stay lit (refer to troubleshooting).
2. Carefully thread the regulator flange nut in the tank valve counterclockwise with your fingers until you feel the flange seat. Tighten firmly with adjustable end wrench. **DO NOT USE PLIERS!** Fasten hose between regulator and generator gas inlet in same fashion.
3. Turn the propane tank valve to wide open "ON" position.
4. Check for gas leaks. A solution of 25% hand dish soap and 75% water in a spray bottle will work well for detecting gas leaks. Apply solution to all previously connected fittings. Bubbles will occur around loose connections. Always use two wrenches when tightening multiple fittings.

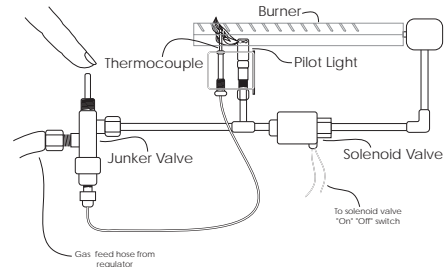
Natural Gas Hook-up



1. Turn gas supply off before you begin work. Now connect a gas shut off valve (not included) onto your incoming gas supply line. If needed reduce to 1/2 male nipple to accept enclosed regulator. Note gas flow direction indicator arrow. Use gas compatible pipe compound on all pipe thread fittings and tighten securely.
2. Connect regulator to shut off valve nipple with compound and tighten.
3. Check for gas leaks. A solution of 25% hand dish soap and 75% water in a spray bottle will work well detecting gas leaks. Apply solution to all previously connected fittings. Bubbles will occur around loose connections. Always use two wrenches when tightening gas fittings.

Igniting Pilot Burner

1. Plug the transformer into a grounded 110 volt timer or other power source.
2. Depress the RED button located on the inside of the generator for 90 seconds to clear the air from the hose.
3. Once gas is present at the pilot let up button and wait 60 seconds for excess gas to clear from the housing. Now depress the RED button again and light the pilot burner. Maintain holding the button down for an additional 30 seconds to allow the thermocouple to heat to operating temperature.
4. Push the front on-off switch to the "ON" position. Fuel will pass through the solenoid valve and the main burner will be ignited by the pilot flame. As your timer cycles on and off so will the main burner flame.
5. For the CD-18 and CD-36, the brass needle valve may be used to vary the flame size. This will increase or decrease the time that the unit needs to charge the area with CO2. The specs are based on the valve being fully open.



Trouble Shooting Tips (see www.greenair.com for further information)

PILOT LIGHT FAILS TO IGNITE:

Make sure propane tank has fuel and valve is fully open. For natural gas generators make sure gas supply is "On" and shut off valve is open. Make sure propane tank has not been overfilled. If so, take tank outdoors and open valve to release gas for a few seconds and reconnect. Remember red button must be depressed to light pilot.

PILOT LIGHT WON'T STAY LIT:

Hold the red button down to clear all pockets of air from inside the hose. Make sure the propane tank has not been overfilled. If so, take tank outdoors and open valve to release gas for a few seconds and reconnect. Remember, red button must be depressed for 30 seconds or until the thermocouple heats to operating temperature and holds pilot open.

BURNER FAILS TO IGNITE:

Check that the tank valve is fully open. Be sure all air has bled from the hose and gas is present. Make sure the transformer is plugged into a working power source. Make sure power indicator switch is in "ON" position. Check that needle valve is open.

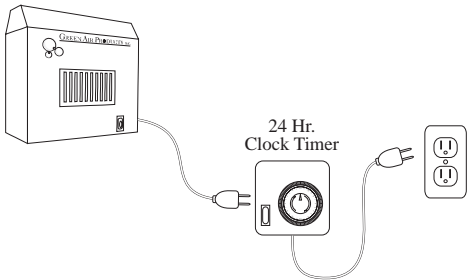
BURNER WON'T STAY LIT:

Check that needle valve is open enough to support a strong minimum flame. Check timer and power source operation.

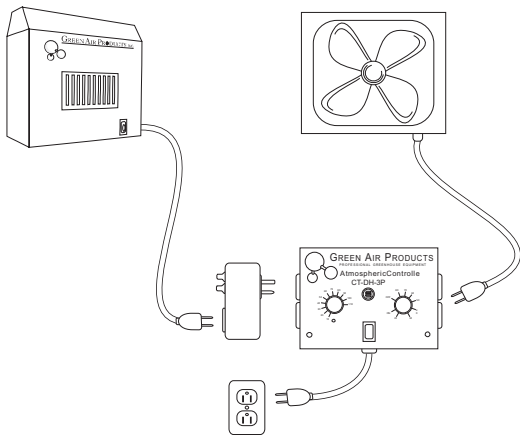
FLAME BURNS IRREGULAR:

Dirt or residue could constrict burner orifice. Low fuel pressure due to depleted or contaminated fuel supply. Lack of oxygen content in room due to inadequate fresh air intake. Excessive air movement or gust from fan or ventilation. Generator not setting level.

Control Diagram

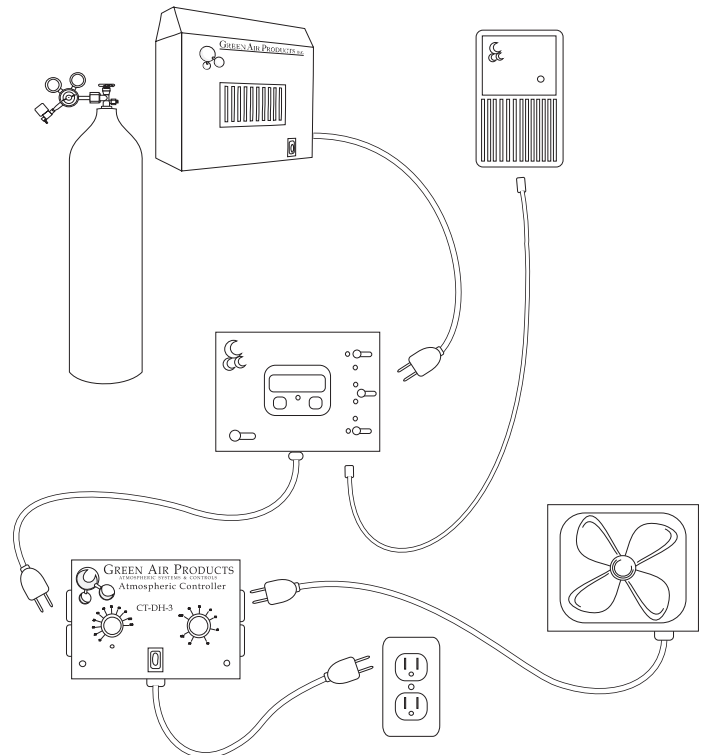


This example shows the simplest method of CO₂ generator control. Set the Green Air Products Timestat, Cyclestat or PDT-1 timer for short intervals during light hours only.



This diagram demonstrates an exhaust synchronized system where the CO₂ equipment is disabled during exhaust functions and immediately replenished when exhaust is completed. The CT-DH-3P temperature and humidity controller activates the exhaust fan and shuts off the CO₂ during the exhaust cycle. It has a built in photo sensor to limit CO₂ enrichment to photoperiods only. Enrichment will only occur when exhaust fan is off and light is present. The CO₂ "On" cycles are timed by the Cyclestat repeat cycle timer which cycles the CO₂ equipment according to your preset periods. An example might be that the timer is set for 5 minutes every hour. The CO₂ generator would be operated according to that hour schedule. In the event that there is an exhaust function at any time the CO₂ will come on for 5 minutes immediately after the exhaust cycle is completed. It will repeat again one hour after that point. Replenishment of CO₂ will always follow an exhaust cycle to maintain a constant and continuous enrichment level.

Exhaust Synchronized Operation



This system is the ultimate in precise automated CO₂ control. The CDM-6000 sensor continuously determines atmospheric CO₂ values. The CDD-2 controller interprets these values and provides flexible set point adjustments to sequence CO₂ equipment functions. The CDD-2 has a built in photo sensor to disable CO₂ production during darkness. The CDMC-6 system can be combined with the CT-DH-3 temperature and humidity controller to defeat CO₂ production during exhaust functions. The CO₂ generator (or emitter system) and the monitor are plugged into the CDD-2 controller. CDD-2 controller and the fan are plugged into the CT-DH-3 as shown. Plug the power cord from the CDD-2 controller into the left hand equipment outlet on the CT-DH-3. The power to the sequencer will be interrupted when ever the temperature or humidity conditions constitute an exhaust function. CO₂ production will resume immediately after exhaust cycle is completed. CO₂ levels will be maintained precisely and automatically. Order the CDMC-6 for this Carbon Dioxide Monitor Controller combination.