



PowerPallet Operation Manual

10kWPP & 20kWPP



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*ALL Power Labs, Inc
Berkeley, CA
sales@allpowerlabs.org
support@allpowerlabs.org*

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I. Recommended Tools

- dry feedstock (*please see the Feedstock Requirements documentation*)
- igniter fluid (ie: gasoline, diesel, kerosene) (optional)
- squirt bottle for igniter fluid (provided)
- step stool
- adjustable wrench
- 1" plug
- CO meter (provided)
- broom handle or long pole
- eye protection
- gloves for touching hot surfaces
- computer and USB cable (only if data logging)

II. PowerPallet Basic Operating Instructions

A. Lighting the GEK Gasifier

1. On the Control Panel, turn the Power Switch to the 'ON' position.
2. Open the Flare Gas Valve and close the Engine Gas Valve.
3. Open the Ignition Port on the Reactor.
4. Close the Air Inlet on the Reactor by using a 1" plug or blocking air entering with your hand.
5. On the Control Panel, turn the Air Blower Knob up until P_{react} is between 1 - 2 WC as displayed on the LCD screen.
6. Use a hand held propane torch to light the Reactor through the Lighting Port.
7. When T_{tred} increases to about 60C and continues to climb, open the air inlet valve and place the ½ cap on the Lighting Port.
8. Increase the gas flow rate to (P_{reac}) to 4 WC while also slowly increasing the Air Blower.
9. The automated igniter should light the flare and give a low roaring sound. If the flare is seen above the top of the stack, increase the flow of the Air Blower, or decrease the Gas Blower Knob on the Control Panel.
10. Ideal temperature ranges (for minimal tar content in the gas stream) in the Reactor are 750-850C for the bottom of reduction temperature (T_{bred}) and 800-950C at the constriction (T_{tred}).
11. To increase the temperatures in the Reactor, increase the gas flow by turning the Gas Blower Knob while maintaining a steady flare by adjusting the air mixture with the Air Blower Knob.

B. Running the Engine and Creating Power

1. Adjust the flow rate of the Gas Blower to increase the both T_{tred} and T_{bred} temperatures above 750C.
2. Close the Flare Gas Valve and Turn the Gas and Air Blowers off.
3. Open the Engine Gas Valve
4. Turn the Key Switch to crank the Engine. (Some models may have a push button start. Push the Start button after switching the key switch to the 'ON' position).
5. Apply a load to the generator once the engine is running.

C. Switching back to the Flare from the Engine

1. Turn the Key Switch to stop the engine.
2. Close the Engine Gas Valve.
3. Open the Flare Gas Valve.
4. Turn the Gas Blower Knob for low flow.
5. Turn the Air Blower Knob until the flare lights in the Flare Stack.

D. Shutdown

1. From Engine Mode: turn the engine off by using the key to turn the Ignition Switch to the 'OFF' position and close the Engine Gas Valve.
2. From Flare Mode: Close the Gas Flare Valve and Turn the Gas and Air Blowers off.
3. Place a 1" cap on the Reactor Air Inlet.
4. Disconnect the negative lead on the battery for longer storage times.

III. Understanding System Dynamics

A. Lighting the Flare

During the initial lighting of the Reactor, you may see white ‘smoke’ coming out of the Flare Stack. This is water vapor boiling from inside the system. The flare inside the Flare Stack will catch when producer gas is being produced from the Reactor. As the Reactor warms up the CO and hydrogen content will increase in the smoke and the flare will light. If there is too much water in the feedstock or the system, it may be difficult to light the flare.

B. Cranking the Engine

It is common to have air in the Gas Line and the Gas Filter when first attempting to start the engine. For this reason, you may have to crank the engine for longer than what it is typical for a vehicle. However, only crank the starter for 6-8 seconds while allowing the starter to rest for a couple of seconds to prevent over heating. While the engine cranks, the air will purge through the system until the producer gas reaches the engine. At this point the engine will start running on producer gas.

C. Power demand and Temperature

The lower power load on the generator will cause the engine to consume (pull) less producer gas from the Reactor thus decreasing air flow into the Reactor. This will in turn decrease the temperatures in the Reactor. Similarly, the higher the load on the engine the more producer gas is pulled from the Reactor which creates a greater vacuum on the Reactor causing more air to enter the system via the Air Inlet on the Reactor. With higher power loads the temperature increases in the Reactor. This is why gasifiers are sized specifically for a certain engine/generator’s power range. Drier fuel will correspond to higher Reactor temperatures with a given load. Monitor these variables to get an understanding of how the characteristics of your selected feedstock effects the temperature coupled with your power demands on the system. Ideally maintain temperatures above 800C in the Reactor.

D. Filling the Hopper with Feedstock

The hopper is to maintain an air tight seal during normal operation. However, the hopper can be filled periodically during operation by opening the lid of the hopper and adding feedstock, however, only open the hopper for 8 seconds (10 max) at a time. If the reactor is hot, *only fill the hopper when the reactor is lit and there is a vacuum on the system. DO NOT fill the hopper if the gasifier may contain hot charcoal, but the hopper and gasifier system has completely run out of raw feedstock.*

IV. PowerPallet System Start-up Check List

Item	Correct Operational Status
Charcoal in GEK Reactor	Charcoal should completely fill the space above the Ash Grate and the Reduction Bell and ~6 inches below the GEK Reactor Lid.
Hopper Barrel filled with feedstock	Feedstock <15% moisture will ensure a quick/easy start up, although feed stocks with <25% moisture by dry weight is allowed. Never run the PowerPallet with an empty hopper.
Gas Filter	Confirm that gas filter is not clogged.
All seals and connections are air tight	No air leaks in the system (Hopper Lid, Reactor gaskets, instrumentation ports, gas line connections, condensate jars, and Gas Filter Lid).
Air filter	Engine air filter clean enough for sufficient air flow.
Engine oil	Filled to proper level.
Engine coolant	Filled to proper level.
12vDC Battery	Battery is fully charged. Critical for best blower performance.
Power to the main Control Panel and PCU	PCU LCD shows main screen when ON.
Thermocouples	Reading proper temperature. (Check this during the run or you can hold a propane torch to the thermocouples to register a reading).
System pressure drop	Blowers are able to pull at least 5-6 WC vacuum on reactor.
O2 sensor reading	O2 sensor indicator on Main Control Panel flashes start-up tasks before entering stand-by. Number should display on the dial.
Flare Igniter	Igniter should turn ON when Reactor vacuum (P_Reac) is greater than 0.5 WC. Check visually to make sure the Igniter turns ON (glows red).
Biomass Auger feed	Runs properly (not obstructed) and fills reactor with feedstock. Alarm will sound if not working properly.
Clearance for rotational components	Make sure nothing is obstructing the rotational components of the generator or engine (ie: wood chips, tools).
Flare or exhaust stack	Make sure nothing is obstructing the hot gas exits of the Exhaust and Flare Stack.
Check CO meter	CO meter is near the operator and has sufficient battery.
Air Pre-Mix servo	Jog the engine by briefly cranking the engine. The positioning indicator on the Air Pre-Mix servo should respond.



PowerPallet Operation Quick Reference Guide

Start-up Check List

- Charcoal in the GEK reactor
- Filled feedstock hopper
- Gas filter & air filter
- Air tight seals & connections
- Engine oil/coolant
- Battery Charged
- Thermocouples
- System pressure drop
- O2 sensor
- CO meter
- Biomass auger feed
- Clearance around system (ie: flare and exhaust stack)
- CO meter
- Recommended tools

Before proceeding: Please read the *PowerPallet Operation Manual 10kWPP & 20kWPP* and *PowerPallet Setup, Maintenance, and Troubleshooting* documentation for complete operation details and guidance.

For further information, visit our website www.gekgasifier.com. For technical assistance, please contact support@allpowerlabs.org.

Quick Start-up Instructions

Start-up:

1. Turn power On
2. Open Flare Gas Valve
3. Turn on Gas Blower for 1-2 WC on P_{react}
4. Light Reactor w/ propane torch through Ignition Port
5. Cap Ignition Port when T_{red} is climbing and >60C
6. Increase Gas Blower to 4 WC
7. Increase Air Blower until the flare lights and the flame is pulled down into the burner and not seen above the top of the Flare Stack.
8. Increase Gas Blower to reach >800C but <1000C. Adjust air blower as needed.
9. Turn off blowers, close Flare Gas Valve, and open Engine Gas Valve.
10. Crank the engine. Engine will start when air is purged from the gas line.

Shutdown:

1. Turn off engine, or turn off Air and Gas Blowers
2. Close Engine and Flare Gas Valves
3. Make sure Air Inlet on the GEK Gasifier is closed.



ALL Power Labs
personal scale power

ALL Power Labs, Inc
Berkeley, CA
sales@allpowerlabs.org
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