



The Dead Stick Flyer

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Tech Corner: Walbro 2 Stroke Gas Diaphragm Carburetors

By: Ron Lazzeri

Topic: Carburetor troubleshooting, rebuilding, and tuning tips

Like the old adage goes, “when it’s good it’s good but when it’s bad it’s bad.” That saying must have been coined for our RC gas engines because when they are running great life is good but when they start to run bad or quit, while in flight for no apparent reason, life suddenly SUCKS! If gas engines always ran great we would not have any work to do on these machines but that is not always the case.

Luckily, some engine problems are easy to diagnose and fix like a simple tweaking of the high and low needle jets, changing a fouled spark plug, or even simpler, getting fresh gas. However, there are certain cases when an engine problem is not easy to diagnose, let alone fix it. So, when that happens who do you turn to? What do you do? There are always some guys in the club that are engine gurus but they are not always readily available and/or willing to spend a great deal of time that it usually takes to help solve your engine crisis.

I wrote this article with the intention to help guide you in the process of troubleshooting, rebuilding, and tuning the most likely cause for your engine dilemma, the Walbro Diaphragm Carburetor. The Walbro carburetor is probably installed on the majority of our RC engines and is responsible for the engine running great, as well as, running like CRAP! In addition to this introductory article, there is a wealth of information on the web that can be found with some simple searches and a little detective work to find information that pertains to your engine’s issue. Even though a lot of the articles found on Walbro diaphragm carburetors, on the internet or elsewhere, may not be directly related to our RC engines, the basic operation, repair, and tuning of these diaphragm carburetors is the same or very similar.

Ethanol: First off, the majority of today's carburetor problems stem from Ethanol based fuels. The problem with Ethanol is that it attracts water and forms water bubbles in the fuel. Small 2 stroke Engines have trouble effectively passing the water which keeps the engine from running properly and can affect its power. Over time, Ethanol wrecks carburetor gaskets and internal parts which cause the engine to run poorly or not at all. The other issue caused by Ethanol Fuel is when an engine sits idle for a long period of time (3-6 months or longer) the liquid gas will congeal and clog internal carburetor passages requiring the carburetor to be cleaned and rebuilt or in severe cases replaced. There are several after-market products that claim to reduce or eliminate the effects of Ethanol in the gas, Like Stabil and Star, but at best they may only delay the inevitable.

Let's look at the top 10 major reasons for carburetor problems:

- 1. Ethanol based fuels wrecking carburetor parts**
- 2. Dirt in the carburetor: clogs passages, faulty or no fuel filter**
- 3. Fouled spark plugs: engines running too rich or too lean, too much oil**
- 4. Magneto engines: fouled magneto, no spark**
- 5. Electronic engines: fouled electronic ignition, battery issues, wiring issues**
- 6. High & Low needle valves set incorrectly: too rich or too lean, not balanced**
- 7. Fuel delivery: leaking fuel lines, air in the lines, pinched tank clunk**
- 8. Loose screws: screws holding the carburetor together are loose, causes air leaks**
- 9. Damaged Carburetor Parts: metering diaphragm/gasket, fuel pump gaskets, fuel screen, metering needle, pitted needle seat, metering spring, welch plug/ports**
- 10. Engine Pulse Passage: clogged, leaking gasket or hose, low/no pressure**

Now, the first place that I will introduce you to is Walbro. www.walbro.com

Walbro designs and manufactures these carburetors so where better to look than Walbro. When you look over the Walbro website you will find numerous topics that may help you solve your problem or find the parts you need so you can order them or buy them at your local parts supplier.

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WALBRO PARTS & SERVICES

FEATURED PRODUCTS

FUEL SYSTEM KIT

PRIMER ASSEMBLY

POWER EQUIPMENT COMPLETE FUEL SYSTEM KIT

DESCRIPTION **FEATURES**

Walbro's new Power Equipment Complete Fuel System Kit includes a Scented Fuel Treatment, Carburetor & Fuel System Cleaner, and Power Equipment Duster. Walbro's unique formula of cleaners and lubricants both cleans and protects your fuel system.

Hi! Welcome to Walbro!

Are you looking for information on proactive engine maintenance? Or questions on any of our products in our shop?

Parts & Services Products

Walbro has a very good detailed carburetor rebuilding training video on their “Parts & Service” menu. Click on the “Parts & Service” menu and go to the bottom of that page. There you will find the section called: “Walbro Carburetor Service Video.” It will show you all of the training topics that will be discussed and when you start the video, the Walbro training execs will show you, in detail, how to take apart, clean, rebuild and test a diaphragm carburetor from start to finish. They will show you a very important step which is to do a pressure test on the carburetor after it has been rebuilt to make sure it is not leaking and will hold its internal pressure so that it delivers the proper measured fuel as the engine calls for it. This is the best starting point to understand how to troubleshoot and rebuild a Walbro diaphragm carburetor properly.

WALBRO CARBURETOR SERVICE VIDEO

New: Walbro video featuring hands-on demonstrations of key service procedures including inspection, proper disassembly, testing, and reassembly of butterfly and rotary carburetors.

This all-new, 21 minute video demonstrates the proper techniques for servicing Walbro butterfly valve and rotary valve diaphragm carburetors. The video will be of value to dealers, service technicians and technically-oriented consumers. [More Info](#)

WALBRO CARBURETOR SERVICE

Section 1: Carburetor Basics (0:52)
 Section 2: Initial Engine Inspection (1:52)
 Section 3: Butterfly Valve Carburetor Operation (5:10)
 Section 4: Butterfly Valve Carburetor Inspection (6:45)
 Section 5: Ethanol Fuel Discussion (10:36)
 Section 6: Tamper-Resistant Features (Butterfly) (12:23)
 Section 7: Rotary Valve Carburetor Operation (13:28)
 Section 8: Rotary Valve Carburetor Inspection (15:49)
 Section 9: Tamper-Resistant Features (Rotary) (18:56)

SERVICE MANUALS

- In-Tank/In-Line Filters
- Tech Tips

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Parts & Services Products

Here are some useful tips for tuning your gas engine:

At some point, out of tune engines can begin to "four cycle" in flight. Two stroke engines are not supposed to "four cycle" like a glow engine. This issue is caused by an overly rich needle setting that is forcing the spark plug to intermittently "miss" making it sound like a four stroke glow engine. This is not good. The good news is that gasoline two stroke engines are very tolerant of rich settings and will run fine for a short period of time. The engine will just consume more gasoline than necessary and will create a little more oil mess on your plane. This out of tune situation may eventually foul the spark plugs. So why do so many people leave their engines tuned like this? The simple answer is the engine starts OK for them when it's cold and there's little or no warm up time needed prior to flying. That's a pretty good reason, but the fact is, the engine is not running like it's supposed to. A minor tweaking of the low or high end needles can fix this issue.

The low end needle on a Walbro carburetor is always the needle closest to the engine and the high end needle is always the needle closest to the intake bore and choke. Both the low end and high end needles feed the mid-range to top end fuel supply. The proper balancing of both needle settings is critical for a smooth running engine.

Tuning a Walbro Carburetor (one of many tuning procedures)

I have found this method to be very effective in tuning my gas engines:

Definitions:

- Open needle means counter-clockwise turns (to richen mixture)
- Close needle means clockwise turns (to lean mixture)

1. Optional step if you want to start with fresh settings:

RESET High & Low End Needles: With the engine off, open both the low end & high end needles to about 1-1/2 turns from their fully closed position as a rough starting point. This will ensure they are not set too lean.

2. CHOKE: Choke the engine until the carburetor is wet.

3. STARTUP: Start the engine and let it warm up for about 3-5 minutes. Do not tune a cold engine.

4. SETTING HIGH END NEEDLE:

- a. Begin this step by adjusting the high end needle.
- b. Go to full throttle or as fast as the engine will allow at this time.

- c. *Slowly close (or open) the high end needle until the engine reaches its maximum RPMs. Continue to advance to full throttle and continue to find the engine's maximum RPMs by closing the high end needle to the point where the engine reaches its highest RPMs and then begins to lose RPMs. Then, open the high end needle slowly until it reaches its highest RPMs again and from there open the high end needle ¼ turn.*
- d. *Let the engine run wide open for about a minute to see if the engine goes lean (loses RPMs). If it does, then open the high end needle slightly until the engine reaches its maximum RPMs again and then from there open the needle ¼ turn.*
- e. *The engine should hold its maximum RPMs now.*

5. SETTING LOW END NEEDLE:

- a. *Begin this step by adjusting the low end needle.*
- b. *Set the throttle to approximately 3000 RPMs.*
- c. *Slowly open or close the low end needle until the engine reaches its maximum RPMs from the 3000 RPMs setting. Then, reset the throttle back to 3000 RPMs.*
- d. *Double check the engine's maximum RPMs setting again while at 3000 RPMs by slowly opening or closing the low end needle to find the maximum RPMs.*
- e. *Reset the throttle back to 3000 RPMs.*
- f. *Let the engine run at 3000 RPMs for about a minute to see if it holds at that setting.*

6. CHECK OVERALL TUNING:

- a. *If the high and low end settings run OK from steps 4 & 5, then advance to full throttle and slowly pull the throttle down, one click at a time, to see if the engine begins to four cycle or sputter and hold the throttle setting where the engine begins to four cycle.*
- b. *Slowly open or close the low end needle until the engine runs smooth again.*
- c. *Continue slowly lowering the throttle to see if it four cycles again and adjust the low end needle setting at that throttle setting, as before. Keep doing this until you reach full idle.*
- d. *Now, from full idle, begin to throttle up quickly to full throttle to see if the engine starts to (bog down and/or quit) or (sputter and then speed up). If it does, open or close the low end needle just enough to eliminate the issue. Repeat this step until the hesitation is eliminated.*
 - i. *Rich or Lean indications and fixes while advancing to full throttle:*
 1. *Engine Bogs Down and/or Quits – Low End Needle setting too lean, open needle.*
 2. *Engine Sputters and then Speeds Up – Low End Needle setting too rich, close needle.*
- e. *If the low end needle does not clear up the hesitation completely, try adjusting the high end needle to see if it helps smooth it out.*
- f. *Repeat this process until the engine advances smoothly and quickly without hesitation.*

7. SET THE IDLE RPMs:

- a. *Pull the throttle down to idle and adjust the throttle trim setting until the engine idles at approximately 1,850 to 1950 RPMs or at the RPMs you prefer.*

8. Repeat steps 4, 5, and 6 until you are satisfied the engine is now running smooth and strong.

When this is done right, you will be able to set the throttle in any position and it won't four cycle, plus you will be able to transition from idle to full power without any hesitation. You may need to repeat this process several times until you get it set correctly.

Happy Tuning!

Carburetor Setting Problems:

The engine stalls when accelerated: possible solution - High end needle lean, or low end needle lean.

Engine goes rich in flight: Low end needle slightly rich, metering diaphragm needle lever slightly too high.

Engine goes lean in flight: High end needle slightly lean and/or low end needle slightly rich, metering diaphragm needle lever slightly too low.

Engine runs good, but no idle at all: There may be dirt (crap) in the idle jets and the carb may need to be removed and cleaned. You may also have an air leak at the base of the carb or the throttle butterfly could be damaged or worn out.

Carburetor leaks fuel when not running: metering diaphragm needle is bad or has crap stuck in it or the metering diaphragm lever setting may be too high, or the metering diaphragm is bad.

Engine four cycles momentarily when you back off on the throttle, then runs normal: This is perfectly normal for carbs not equipped with a "check valve" high speed jet. If the carburetor has a check valve, then the metering diaphragm needle setting is slightly too high, or your float needle is leaking a little. Refer back to the Walbro training video.

Cowled Engine - Diaphragm Pressure Issue: There is a small 1/16" hole in the metering diaphragm plate that allows the metering diaphragm to breathe and pulsate drawing fuel into the carburetor. A common problem with some cowled engines, while in flight, is the air pressure in the cowl increases beyond the ground air pressure causing the metering diaphragm to make the engine run richer than originally tuned. The result is the engine will run rich in flight making it bog down, four cycle or run at higher RPMs while landing. The engine should settle back down to its originally tuned RPMs on the ground after coming to a complete stop.

There are several possible fixes for this if your engine exhibits this issue:

- 1. You could try to tune your engine for its best in-flight performance by trial & error, but that would be somewhat difficult.*
- 2. The best fix for this is to solder a piece of brass tubing where the vent hole is and route the vent hose (fuel tubing) into the fuselage going through the firewall where the air pressure is constant. If done correctly, the ground tune will no longer change in flight!*

Internet Reference Articles and Training Aids:

I have included several of the best articles I found from my Internet searches. These articles all relate to the Walbro Diaphragm Carburetor and provide great examples on how to troubleshoot, rebuild, test, and tune the carburetor. There are many more articles available but at some point they overlap in content and you may get confused by conflicting procedures. Add these articles to your RC Gas engine library for future reference as you never know when they will come in handy.

I felt it was better to present these articles on carburetor tuning to you since they have done a really good job and they go into great detail to make their case for the repair. Remember, while the engines in these articles may not be RC engines, the principles of the Walbro Diaphragm Carburetor are the same as our RC engines.

Enjoy reading them!

Walbro Diaphragm Carburetor Service Manual: Excellent service manual

www.wind-drifter.com/technical/WalbroServiceManual.pdf

Adaptation: Walbro Diaphragm Carburetors - Slow and Smooth Idle

www.wind-drifter.com/technical/GerryFarrel/idleadaptation.htm

Southwest Airsports

www.southwestairsports.com/ppgtechinfo/top80/hrservicenotes/walbrowg8/popoff/pop-off-pressure.htm

Group K: Carburetor Fine Tuning Guide

www.groupk.com/tec-carbs97.htm

How-to Pressure Test a 2 Cycle Carburetor

<https://www.youtube.com/watch?v=LeABb5HqOoY>

I hope this article on the Walbro Diaphragm Carburetor has been helpful and not too difficult to read and understand. Some of the technical explanations can get complicated. Just try to take away some of the basic principles that may be able to help you with your engine's issues. As always, let me know if you have any suggestions to help with this topic.