

O.S 1.60 Cookbook

By Jon Lowe

A lot of people have tried various solutions using the non-fuel injected OS 1.60 as the basis for a modern pattern plane power plant. When I was getting back into pattern, an article by Eric Henderson gave me the idea to try the engine. I went through a lot of trial and error, until settling on a setup that Bob Pastorello came up with, although I have added some tweaks of my own. I have found this to be a cookbook solution, and have used it successfully on 5 of my own aircraft, and I helped Ryan McLaughlin and Joe Walker set up their engines. Ryan won Masters at the Nats this year, and Joe qualified for the semi-finals in F3A, so the engine obviously works in top-line competition. Before I get to the cookbook portion of this, I'd like to review the advantages and disadvantages of the OS 1.60 in pattern use:

Advantages:

- Cheap - often available from Tower for about \$250 with their "dollar off" deals
- Not fussy - not highly tweaked and will run even with off-nominal setups insensitive to slightly off pipe settings
- Easy to start - after the first start of the day, starts with one back flip of the prop
- Relatively low power loss at high ambient temps
- Uses 15% nitro fuel
- Economical on fuel

- Easy on glow plugs
- Headers readily available to custom order (rise, offset, etc.) from Karl Mueller
- Reliable
- Tons of power - swings big props with ease
- Uses readily available Perry pumps
- Simple - no valves to adjust, uncomplicated carburetor
- Separate needle valve assembly allows hard mounting to airframe rather than shaking on the engine
- Tank is not pressurized
- Did I say CHEAP?!

Disadvantages:

- About 3 oz heavier than an OS 1.40; some of this is countered by using the prop nut/washer/adaptor nut I describe below
- No integrated fuel pump
- Side exhaust may force cowl cutouts for clearance of header on some airplanes
- Stock rear bearing doesn't last long
- Have to drill hole for pressure fitting for pump

Ok, here is what you will need for my recipe:

1. OS 1.60, w/out muffler. Stock number LXVB97, www.towerhobbies.com, \$279.99, less with the Tower coupons.
2. VP-30 Perry pump (blue can), Stock number PERG4600,

www.towerhobbies.com, \$29.99.

3. OS 1.40/1.60 FI pressure nipple, OS part number 29407300, Tower stock number LXWY11, \$5.49.
4. Mueller header, \$56.50, shipped. Custom rises/offsets made in 2-3 days, kgamueller@rogers.com.
5. Aeroslave carbon fiber pipe, \$172 shipped, www.aeroslave.com.
6. Pastorello coupler material and one clamp. <http://www.rcaerobats.net/>. You might have to email him if they aren't listed on his website.
7. Strong tie wraps.
8. 1/16" drill bit and hand drill.
9. Spray electrical or automotive brake cleaner (non-flammable type).
10. OS "F" glow plug.
11. 15.75x11" Lockhart re-pitched three blade APC, or 18.1x10W or 18.5x9.5 APC two blade props.
12. 3/8"-24 grade 5 nut from Home Depot/Lowes.
13. Extra OS needle valve ratchet spring, OS part number 26711305, Tower stock number LXCU03, \$1.89.
14. Dave Brown or Great Planes 3/8-24 SHORT spinner adapter with washer. Great Planes, Stock number LXX239, \$4.49, www.towerhobbies.com.

Preparation:

1. Remove the engine back plate screws, and remove the back plate.
2. Light oil soak a paper towel and stuff into the back of the crankcase, particularly in the area of the where

the bottom of the upper left back plate screw is located, looking at the back of the crankcase.

3. Holding the engine over a trashcan with the crankshaft pointing up, use the 1/16" drill to drill through the bottom of the upper left back plate screw hole until it penetrates the inside of the crankcase. Don't worry about the threads; the drill is much smaller than the threads, and itself centers in the bottom of the tapped hole.
4. Continuing to hold the engine with the crankshaft pointing straight up and the paper towel still stuffed into the crankcase, spray out the aluminum shavings from the hole you just drilled with the electrical cleaner/brake cleaner.
5. Carefully remove the paper towel and the small amount of shavings present on it. Ensure the hole is not blocked by anything. If it is, carefully run the 1/16" drill thru it using your fingers to twist it. Make sure there are no shavings present in the crankcase.
6. Replace the back plate, using the pressure tap in the upper left back plate hole, and the screws in the remaining three holes. Don't over tighten the pressure tap, but it is fairly strong and grips with lots of threads, so it doesn't come loose.



O.S. pressure fitting mounted on engine

7. Mount the Perry pump to your firewall, ensuring you can access the adjustment screw and fuel lines once mounted. Use the supplied pressure fitting tube as a distance guide, and don't mount the pump any further from the engine back plate than you have to. You will need to put a layer or two of electrical tape around the body of the pump to ensure a tight fit of the nylon mount they provide. Note the IN and OUT

arrows on the Perry pump for the fuel flow. DON'T adjust the pump from its factory setting.

8. Mount the remote needle assembly to the firewall or other convenient location in the engine compartment. Put the extra needle valve ratchet spring 180 degrees from the first one, and put the holder part of it over the first spring. This keeps the needle from wearing, and provides insurance in case the first spring breaks.
9. Mount the engine. Hook up the pressure fitting to the pressure port of the pump using the tubing supplied with the pump. The tubing will be a very tight fit on the pressure nipple.
10. Hook up the tank outlet line, running thru a good fuel filter first, to the IN port on the Perry pump. Be sure to vent the vent line of the tank to the atmosphere
11. Hook the OUT port of the pump to the IN port of the remote needle assembly



Top of Perry pump mounted to firewall

12. Hook the OUT port of the needle assembly to the engine carb.
13. The proper length of the pipe is set at about a 1/4" gap between the outlet of the header and the inlet of the pipe. Mueller headers are very consistent in overall actual length, regardless of the rise, etc. For longevity of the header, cut the outlet of the header off so that you have just enough length left to get the coupler tubing and a Pastorello clamp on the straight section that is left.
14. Using the section of header you just cut off, couple it to the header with a short piece of coupler material. Use a Pastorello clamp on the header itself, and two strong tie wraps on the extension. Keep about a 1/8th inch



Two coupler stress relieving setup for Mueller header. Also note placement of one spring clamp

- gap between the extension and the header.
15. Using another short piece of coupler, couple the extension to the pipe inlet using two tie wraps at each location. Again, leave about a 1/8th inch gap between the extension and the inlet. This extra coupler and extension relieves a lot of the stress on the header from the engine and pipe movement.
16. Mount the pipe. I typically use a Dave Brown soft pipe mount on the later third of the pipe. You don't have to support the front of the pipe, but you can if you want.
17. Put in the OS "F" glow plug
18. Mount the prop and spinner (after reaming the prop to 3/8") with the Dave Brown/Great Planes washer, then the 3/8-24 nut, then the spinner adapter as a jamb nut. This saves about 3/4 oz. over the heavy OS prop nut/washer/TruTurn spinner adapter. Never had one come loose.
19. Turn the carb idle mixture screw IN two full turns from the out of box setting. This is VERY important. Don't even try to start the engine without doing this. It WILL flood out if you don't.
20. Set the high end needle about 1 3/4 to 1 7/8 turns out.



Home Depot 3/8-24 nut and Dave Brown spinner adapter washer on left, and heavy stock OS/ spinner adapter hardware on right

21. Fill the tank. I use Morgan Fuels Omega or Cool Power 15% nitro interchangeably. I prefer to break-in the engine with Omega.
22. WITHOUT connecting the glow plug, open the throttle wide open, and choke the engine with your finger until a little fuel runs out of the carb, assuming the engine is inverted. With the engine right side up, turn the engine thru about 1 or 2 turns, choking it, after fuel reaches the carb.
23. Lower the throttle until there is about a 1/8-3/16" opening in the carb
24. Hook up the glow plug. Grabbing the spinner, back flip the engine against compression until it starts. If it starts running backwards, lower the throttle until it either stops or reverses direction.
25. Follow the OS break-in routine. Be careful, as the engine will go from slightly rich to blubberingly rich very easily as you adjust the main needle and quit if you richen the mixture too much, especially after you disconnect the plug. If this happens as you are breaking the engine in, clamp off the supply line until it restarts, then release it.
26. Set the high end needle, once you have a couple tanks of fuel thru the engine to very slightly on the rich side.
27. Adjust the low end needle as rich as you can get it while maintaining good engine transition, and not loading up. Adjust it in or out 1/8th turn at a time until you reach this condition. Setting the idle rich helps prevent mid-range leanness. Mid range leanness can be diagnosed in the air as a tendency to not easily break out of 2 stroke back into four stroke, especially on down lines, and a tendency to run lean/ hot in mid range.
28. Go fly!

You will find that after the first start of the day, you can start the engine at idle with a single back flip, EVERY time. I never use

a starter. The first start of the day varies slightly engine to engine. Some want a single choke pull thru, others want 2 or 3. Be careful not to over choke, and use a hot starting battery; I use a Radio South starting battery setup. DON'T choke after the first start of the day. If it doesn't start very easily, go back thru everything above. If the engine is hot, like when you refuel immediately after a flight and try to restart, it will take a few more flips. Once it has cooled slightly, it will restart with one flip. At a contest, some engines will start the first time the second day without choking at all, on the first flip of the day! Depending on your fuel tank height, especially on Composite ARF Impacts with high fuel tanks, you will need to clamp the feed line after fueling. Use a helicopter fuel line clamp. Fuel seems to siphon thru the pump on airplanes with high fuel tanks, and will flood the engine. Symptoms are that the engine will act like it is lean when you try to restart it, and run less and less with each flip until it won't fire at all, but in actuality, is getting very rich. After several flights, if the high speed needle is too sensitive, turn the pump adjusting screw OUT 1/2 turn, or 1/2 turn at a time until the needle is less sensitive. Make sure you can still set the engine blubberingly rich. Don't over adjust the pump.

OK, some FAQs:

1. Q: I've heard you can use the Cline regulator or Iron Bay regulator with the OS 1.60. Will this work?
A: I never got either to work correctly, and I don't like pressurizing the tank in any event. I've had consistent good luck with the Perry pump. I know this works!
2. Q: I don't like drilling the crankcase for the pressure nipple. I'm afraid I'll get shavings in the crankcase. Can't I just put it in the back plate?
A: First, I'm doing it the way OS does it on the FI version of the 1.60 and the 1.40. Second, because of the webbing in the back plate, you cannot put the nipple dead center without extensive machining of the back plate, so it has no chance or rubbing the connecting rod.

You have to offset it, and MUST get it absolutely flush with the inside of the back plate, or it WILL rub on the connecting rod. Believe me, I've seen it. Third, the back plate is thin, and doesn't give much for the nipple thread to grab onto.

3. Q: I've heard that the OS A5 or OS #8 plugs are better in the OS 1.60.

A: I've had consistent luck with the OS F, and can get good prices on them from Central or my local hobby shop.

4. Q: I've heard you should replace the stock rear bearing in the 1.60 before you even run it. Is this true?

A: It depends! I break-in my engines using Omega fuel which contains some Castor oil. Once broken in, I use Morgan Omega and Coolpower interchangeably (actually, I use Morgan Mach 7 club fuel, which is the same fuel, but with different coloring). Contrary to a lot of people, I like a little castor in my fuel, as the varnish helps protect the engine in case of a lean run. Another side benefit seems to be that the stock rear bearings last longer. I don't use after run oil, or run the engine dry after flying, I just empty the tank. I've got one engine with the stock rear bearing that ran all year, well over 250 flights. Whether the castor has anything to do with this or not, I don't know. When I replace rear bearings, I get the rubber sealed, permanently lubed stainless ones from Boca, part number SMR6004-2RS, \$29.95, <http://www.bocabearings.com/main1.aspx?p=product&id=4570&n=SMR6004-2RS>. I haven't had a front bearing go bad. Believe me; you will know it when a rear bearing goes bad. Feels very rough when you turn the engine over.

5. Q: Can I run XYZ brand pipe instead of the Aeroslave?
A. I don't know. You are on

your

own. For about \$172 with shipping, the Aeroslave pipe is a relatively cheap and light solution.

6. Q: I've heard you have to run large fuel line from the clunk all the way to the carb on OS 1.60s. A: Yes, I do that. It seems to be necessary on many un-pumped 1.60s in sport airplanes. You probably don't need it with a pump, but I haven't tried it. Sullivan sells a large line stopper kit for the fuel tank, and Dubro sells a large clunk. Sullivan also sells a large version of their crap trap filter to fit large line.



Clockwise from top left: OS pressure fitting, large Sullivan stopper and lines, large Dubro clunk, large Sullivan crap-trap filter. Center: Helicopter fuel clamp

7. Q: What RPMs do you turn with xx prop?
A: I don't know. Never bothered to measure it. I have a ton of power - that I do know!
8. Q: I've heard that Perry pumps wear out after 350 flights or so. True?
A: I haven't seen it happen. Not saying it won't, but I haven't seen it. But a new pump only costs about \$35, so carrying a spare is cheap insurance.
9. Q: Do I need to baffle the cowl?
A: I do on some airplanes, if there seems to be a tendency to run slightly hot. With the brutal summer we've had this year, it is good insurance. Also a good idea to direct some air towards the crankcase from the cheek cowls.
10. Q: Where do I get nose rings for the 1.60?
A: Andy Pollitt, <http://www.countryworkshop.ca/planes/andy/>

home.htm, \$15 plus shipping.

11. Q: What mount should I use?
A: I've used both Budd and Hyde type AR and ARI mounts with success. I didn't like the ARI much, and prefer a separate nose ring mounted in the fuselage.
12. Q: I've heard of turning down the aluminum drive washer and gun drilling it to lose weight. Does this work?
A: Haven't tried it, yet, but it is on my list of things to do. The drive washer is bigger in diameter than the prop hub and bigger than the bearing surface on TruTurn lightened back plates. OS did the gun drilling on their .70 Ultimate 4 stroke, so obviously it works on some engines. I would be careful to not get too close to the woodruff key notch, or the outer diameter of the hub. I found a picture of a 1.60 that had the gun drilling done overseas.
13. Q: Do I need to add an extra head shim to make the engine run right?
A: No.
14. Q: What spare parts do you take to a contest?
A: Haven't needed much yet, but I take a needle valve ratchet spring, a woodruff key (easy to lose), spare rear bearing (I've changed them on

another guys engine at a contest, but not on my own), pressure fitting, header (been known to break, but not with the extra coupler I describe), pump, and some carb internal o-rings in case I get dirt in something.

15. Q: Why don't you use a starter?
A: I've had better luck with starting by hand. I also had problems with blowing out the plug seals the first year I ran the engines, especially on a warm start. I stopped using the starter when I found it started much easier by hand, and haven't had a problem with plugs since. Plugs last indefinitely now. My theory is that the head would get fuel in it, and the hydraulic pressure of the fast turning starter would blow the seal.



Gundrilled drive washer

Addendum to the OS.1.60 Cookbook

I discovered some more information on ways to make my setup described in the Dec. 2006 KFactor work even better. Ryan McLaughlin kept having lean runs that we could never seem to sort out. He had been through everything at least twice, and we just couldn't seem to get rid of the issue. It would seem to be ok one flight, and back the next. I wasn't having any issues at all, until after the 2006 season ended, and I started practicing the 2007 Advanced sequence. I normally do two sequences per practice flight, and I noticed that as I got toward the end of the flights, the engine started to run lean. I had not had an issue when I was doing the 2006 intermediate sequences. Some flights seemed to be worse than others, but the problem was constant. I started trying the same things Ryan had done, all to no avail. I was landing with at least ¼ of a tank of fuel left, so running out of fuel wasn't the issue.

One time when I was practicing with Lamar Blair, his YS 1.60 started to act up. He said he had forgotten to put in the foam covered clunk in his tank that YS 1.60's use to prevent any air from getting into the feed line. I filed this bit of information, and didn't think much more about it.

I continued to have issues, and when Lamar brought his plane out again and still had forgotten to put in the foam clunk, I asked him some more questions. I put two and two together, because I remembered seeing that a "bubble less clunk" was an optional part for the OS 1.60. I also knew that OS 1.60s don't like air bubbles at all, and thought that the existing clunk might be sucking air when the tank got down below 1/3rd full. I went to my local hobby shop (LHS), to see what he had. He'd never heard of the OS part, but he had a sintered brass clunk made by DuBro. It seemed a little small and light, but I thought I'd give it a try.

I put it in my tank and flew the next day. Boy, what a difference! I had no lean runs all day, and even ran the tank basically dry a few times without any lean runs. I still wasn't satisfied with the DuBro piece since it was so light, and I was advised that they'd been known to come apart over time. I did some checking on the internet, and found that three clunks were made that fit the bill. I also let Ryan know about the discovery, and he went out and got a YS clunk, which cured his problem.

First, is the YS clunk that Central Hobbies sells. It is part number YSE4720, and is available on their YS 1.60 parts page for \$12.95.

www.centralhobbies.com/Engines/parts/ys160ex.htm

Second is a similar clunk that the helicopter guys are using. Many are using this in place of a header tank. It is called an ELD clunk for "Every Last Drop" on the packaging, and the Fuel Magnet on the website. It has replaceable foam, and is available from Ricks Helicopters, and perhaps some LHS's that specialize in helicopters for about \$16.00.

www.ronlund.com/Merchant2/merchant.mv?Screen=PROD&Store_Code=heli&Product_Code=OMIFUELMAG

Finally, there is the OS “Bubbleless” clunk. Unlike the other two, it is all metal, and appears similar to the DuBro clunk, although it is plated. It is a sintered material of some kind, and is heavier than the DuBro piece. It is OS part number 71531000, and should be available through your LHS, or Tower Hobbies, for about \$14.50.

<http://www2.towerhobbies.com/cgi-bin/wti0001p?&I=LXXF25&P=7>

I’ve used the helicopter piece and the OS part, and Ryan has used the YS part. All seem to work, so use whatever is most available to you.

I’d given my Dad one of my Arresti’s with an OS 1.60. He has having problems with the engine not putting out as much power as it had been. When a coupler had burned through, he had “simplified” the coupler arrangement I’d had, using a single coupler, rather than the two I had with a short straight piece of aluminum between them to prevent header cracking. His arrangement ended up shortening the overall length about 1.5” to 2”. I reinstalled two couplers and the short extension, and now the engine puts out the power it used to have. Again, as I stated in my article, the stock Mueller header length is about perfect. I’d cut the end of the header just short of the last bend, and used the straight piece that resulted with the additional coupler on the advice of Karl Mueller. This takes load off of the header, and they last a LOT longer without cracking this way. While the 1.60 is relatively insensitive to pipe length, you can get them too short and too long.

Some people from out of the US had asked me about Karl shipping headers overseas. He informed me that he has shipped them all over the world, so that is not an issue.