

The Care and Feeding of Model Aircraft Engines

by Darwin Evelsizer

Model engines are precision machines and deserve careful and unique treatment. Modern model engines will last many hours of running time if treated properly. The three worst enemies of engines are heat/friction, vibration and foreign material inside the engine.

BREAK IN PROCEDURES:

Remove the backplate, carb and head to check for loose metal particles. Remove any that you find. When you put the head back on, torque the head bolts equally and in a pattern of one on one side and then the one on the opposite side. Torque each bolt a little bit, then go around the head again and then a third time, tightening them a little more each time. If you have never done this disassembly process before or are unsure of how to go about it, get some help.

Do not turn the engine over, (rotate the crankshaft), with the cylinder dry. Put some oil in the exhaust and down the carb first. Dry, metal parts moving against each other can cause serious scoring before you even start the engine the first time.

Spinners look pretty and provide a convenient place to use an electric starter, but they are **FREQUENTLY** a major source of vibration. The plastic ones are sometimes molded a little off center or there is thicker material on one side than on the other. Uneven torque on the cone mounting screws can cause uneven stress and catastrophic failure. All of these cause the spinner to be out of balance. Aluminum spinners turned from bar stock are the exception to this. Spinners that rotate about a slight eccentric rather than a straight line through their centers will cause excessive premature wear on the engine and destroy a radio very quickly. The same is true of unbalanced propellers. Plastic spinners should **NEVER** be used on any engine larger than about 1.0 cubic inch. The torque and centrifugal force of the larger engines can cause the spinner to shatter. If you do use a spinner, insure that it is balanced when you cut the openings for the propeller blades and that these openings do not touch the prop itself.

Use only a **BALANCED** propeller. Propellers are frequently out of balance when you buy them. Get one of the commercial balancers for a few dollars and use it. Sand off material from the front side of the blade at the tip. Don't sand the backside off as you can change the pitch or create an asymmetrical airfoil, (more vibration).

Most modern model engines require very little running on the ground prior to actually flying them. This is especially true of ringed engines. Engines with a slug piston, (no ring), do seem to like a little more running in first. Do the break in running in a test stand on a work bench or in the plane, but have it up off of the ground. When the plane is sitting on the ground running at full

speed, the carburetor is sucking all kinds of dust and debris into the engine and doing serious damage. It is not a good idea to do a lot of taxiing up and down the field for this same reason. You are gaining a little bit of experience in keeping the left and right sorted out, but you are torturing your engine at the same time.

Use a good quality of CLEAN fuel. Home brew fuel is OK, if and only if, the ingredients are stored correctly, a careful, consistent mixing formula is followed and the fuel is put into CLEAN, DRY containers. Empty milk cartons are a very poor choice because they are made of a thin plastic and frequently leak or rupture. A gallon of fuel on your living room or model room floor doesn't go over too well with the wife. Do not store plastic fuel jugs directly on a concrete floor. I don't know why, but they usually develop a leak on the bottom for some reason.

Strain the fuel from the store container through a coffee filter in a clean, plastic funnel into your flight box fuel can. Have a filter on the bottom end of the pick up tube inside the flight box can and another filter on the outside line between the can and the fuel pump. If your fuel is filtered in this manner, you can eliminate that in-line filter on the plane, which is frequently a source of engine problems. If you are using one of the rubber squeeze bulbs to get fuel from the can to the plane, INSURE IT STAYS CLEAN. When you lay it on the dirty ground and then stick it back into the fuel can, you are contaminating the fuel. Get one of the little kits for installing short, metal tubes through the can lid. Then you don't have to leave the can sitting around with the lid off and letting all kinds of debris fall into the open can and you don't have to stick that dirty fuel bulb tip into the can.

When you run the engine for the first time, set the needle valve 4 or 5 turns out. This is extremely rich and may not even run. The idea is to avoid starting the engine up lean and having it cook itself in the first few seconds. Give the engine a healthy prime and start it. If it dies after a blubbery few seconds, turn the needle valve in a quarter of a turn and try again. Repeat until the engine will remain running.

Run the engine at full throttle and extremely rich for about 2 minutes, then shut it off and let it cool down completely. Restart and run again, turning the needle valve in until the engine picks up speed noticeably. Hold the high speed for 5 to 6 SECONDS and then turn the NV to rich again. Repeat the leaner run for a few seconds longer after about 20-30 seconds of rich running. Do this for about 4 to 5 MINUTES and then shut the engine off and let it cool down completely. Run 1 or 2 tanks of fuel through it following this rich, lean, rich, lean schedule and the engine should be ready to fly. Ensure the engine is a little rich for the first several flights. Each successive flight can be a little more on the lean side until you achieve the final desired setting..

ABC engines, (Aluminum piston running in a Bronze cylinder with a Chrome lining) must be broken in using a somewhat different procedure. The ABC engines are deliberately machined with the top of the cylinder liner being several thousandths of an inch smaller than the rest of it. When the engine is running at design temperature, the top expands to be the same diameter as the rest. If you run the engine very rich, it doesn't get as hot as it is designed to and therefore doesn't expand as much. This causes severe wear and tear each time the piston gets to the top. You have to start the engine and run it at very close to the maximum lean setting. Get it into the air as soon as possible and let it "break in" while flying.

If you have any doubts or don't understand the terminology in these recommendations, ask for some help. If you cook your brand new engine, you are going to have a miserable time trying to learn to fly.

AFTER RUN CARE:

When you are done flying for the day, start up the engine and pull the fuel line off the carb at high throttle. After the engine runs out of fuel and quits, try to restart it again without reconnecting the fuel line. It probably will restart and run for a couple of seconds. Repeat until you have run ALL the fuel out. The alcohol in any fuel left in the engine will attract water, combine with the nitro methane, form nitric acid and cause rust to form inside the engine. After you have run all the fuel out, give the engine a large dose of oil down the carb or in the crankcase vent line for 4 strokes and flip the prop a couple of times. Use gun oil, Rislone Oil, Marvel Mystery Oil, etc. 3 in 1 oil is better than nothing, but it is really too thin to do the job we are after. WD-40 is a no-no because it holds rust in suspension and lets it eat up the engine the next time you run it. You have to be careful what oil you use with the YS or OS engines with pumps or superchargers on them. Some oil will attack the seals and ruin them.

If you crash an airplane or even dump one out in the dirt field, don't turn over the propeller until you have inspected and cleaned the engine. There is very likely some dirt down the carb and this must be cleaned out prior to anything moving inside the engine. Brush off the visible dirt on the outside of the carb and engine with a shovel, toothbrush and/or cotton swabs and rubbing alcohol. Carefully remove the propeller or what's left of it and remove the carb. If you see even a single speck of dirt inside the carb barrel, disassemble the carb and clean it carefully.

Look down the intake of the engine and inspect for dirt. Use a magnifying glass if necessary. Clean it out with cotton swabs and alcohol. Remove the back plate and check inside the crankcase. After you are absolutely certain everything is clean, oil it all and reassemble. If your engine has a Perry or Irvine carb or any other of the black or gray plastic carbs, do not use any solvent besides alcohol. Lacquer thinner, paint thinner, kerosene, gasoline, MEK, etc will dissolve the plastic. These solvents are extremely toxic and dangerous to use anyway.

All of these suggestions may add up to several dollars expense and what seems like a lot of effort, but it will probably save you from sending your expensive engine to an early grave and save you a lot of headaches with an engine that, "Just won't run right!"

STARTING PROCEDURE:

Open the throttle completely, squirt several drops of fuel in the carb, (I don't like choking and drawing fuel through the line because you don't know how much you are putting down the carb), flip the prop HARD a couple of times WITHOUT fire to the plug. Move the throttle to the idle position, attach the battery and flip hard. Only three things are necessary for the engine to run: a

hot glow plug, vaporized fuel in the combustion chamber and compression. If your engine doesn't start within a few flips using this procedure, You have too much or too little of one or more of these 3 items and you should figure out what is wrong and correct it. Electric starters are handy for starting stubborn, worn out or flooded engines, but they are not necessary and can cover up problems that need to be corrected.

Chicken sticks are a safety thing and some of the "experts" say that you should never use a bare finger to start an engine. It is true that if you never stick your finger in a prop, you are never going to get it cut. I prefer using a bare finger because I have a better feel for or better control of the starting procedure. I have NEVER been cut when I was using correct starting procedures. I have been cut several times when I didn't use correct procedures.

The gray or black plastic/fiberglass/composite props such as Graupner, Master Air Screw and APC have extremely sharp edges on them when they are molded. These should be sanded down enough to remove the sharp edge before using. This is especially true if you are using bare fingers for starting. Doing this at the same time that you balance them is convenient.

I was trying to start a new guy's engine a few years ago when I noticed that it had sharp edges on the Master Airscrew prop. I figured I was good enough to get away with starting it without removing the sharp edges. That little bit of egotism cost me 16 stitches in a finger when my finger slid up the backside of the prop and nearly amputated the tip.

Have fun in this tremendous hobby and remember to ask for help if you are not sure of what you are doing. Nearly everyone can benefit from the experience of those who have traveled this road before.

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