Spark Plugs

As a Seabee owner, you are legally allowed to change and/or clean your spark plugs but you gotta know how and when to do it. This article will help guide you through the process.

Spark plug description

Spark plugs are the heartbeat of your engine. If they stop beating, your engine dies! Aircraft spark plugs are pretty stout and they take a lot of punishment so their operation must be flawless. Energy for the spark is created at the magneto, carried through high tension wires to the spark plugs where the energy is manifest as a flash across a very carefully calibrated gap in the plug. If the engine timing is right an explosion will happen at just the right time to propel our Seabees through the sky.

When to change/clean

The spark plugs should be cleaned and gapped at least every 100 hours or at the "Annual Inspection". Regardless of how they look, they should be cleaned, gapped and tested before reinstalling them. If you notice any physical damage or the center electrode is half the original diameter they must be changed. If they "fail" the Spark Plug Cleaner-Tester test, they must be thrown away or recycled.

Before you begin

Make sure you have the correct manuals and tools for your engine. There are about as many spark plugs as there are stars in the night sky! Not really but there are many to choose from so check with your engine manual for specifications. The Franklin engine originally used Autolite AH-4 spark plugs then changed to A-4 which was essentially the same as AH-4 with a wider electrode. Some Franklin powered Seabees have converted to a more modern plug. Check with your mechanic for the correct plug for your Franklin.

Get the right tools together which include:

- Spark plug socket with extension
- Spark plug caddy (really handy)
- Anti-seize compound
- Dow-Corning #4 Electrical Insulating Compound
- Open end wrench for spark plug nuts (usually 7/8")
- Gapping tools (see below)
- Thread chaser (NOT A TAP! Taps are tapered and could affect the threads)
- Spark plug cleaner/tester (About $45 - $500 depending on design and wallet size.)
- Good torque wrench that's been calibrated
- A nice, clean, flat work bench
- New plugs and copper washers if required

Removal

Open the cowling and remove all the spark plug nuts and remove the rubber insulator from each spark plug. If there is any confusion, label the ends of the spark plug harness with masking tape with correct position (i.e: Cyl #1 top, #2 bottom, #3 Forward, #4 Aft, etc).

Note: The Franklin engines had both spark plugs on the top of the cylinder. For this discussion the "top" plug is the forward position. The "bottom" plug is the aft position. As you stare at the engine from behind the prop or as you sit in the pilot seat the number one cylinder for the Franklin is the farther FWD Right side or co pilot side. And the Lycoming is the farthest aft cylinder on the Left side of the engine or the pilot side of the aircraft. This is important when the engine timing is accomplished. If you have a different engine, check with the manufacturer for cylinder position and plug recommendation.

Regardless of the engine installed, most of what follows is applicable to all engines.

The insulators on the end of the wires used to be called cigarettes because that's what they looked like; Porcelain cigarettes. Nowadays the insulators are usually a silicone plug impervious to our engine temperatures and usually don't break easily. However, if you see any damage to the insulator, fix it. The damage may be bad enough to cause a rough running engine.

Get or make a spark plug caddy. They are readily available at any of the aviation stores and remember you need twelve holes! Automobile holders usually won't work. You could also make one using a short 2 x 4 with 12 ea., 3/4" holes drilled in it and label them "Top", "Bottom", "Forward" and "AFT" as appropriate with the cylinder number next to each hole.

Using the appropriate socket and ratchet remove the spark plugs one at a time and put it directly into the spark plug caddy. Once all the plugs are out and placed in order in the caddy, inspect each one inside and out. DON'T DROP THEM! Check for any damage or heating issues. See chart below:

Warning: If you drop a spark plug, do not pass GO, do not collect $200, throw it directly into the garbage or recycle it. The inner section of the plug is ceramic and cracks very easily so don't take any chances. If you have access to a spark plug "Tester" you might be able to save it but probably not.

There are at least two different kinds of aviation spark plugs; "massive electrode" and "fine wire" (see photo below). The massive electrode plugs are the most common because they are cheaper. The fine wire plugs are more expensive ($150+ each!). Here's what Mr. Google says about fine wire plugs:

> ***"Fine wire spark plugs feature a thin, small-gauge center electrode made from precious metals like iridium or platinum. This concentrated design requires less voltage to fire, creates a hotter and more powerful spark, improves fuel combustion efficiency, and resists fouling better than traditional massive electrode plugs. Fine wire plugs are used when the engine is burning oil or operates at a high altitude. If your magneto is pressurized (for high altitude) you're probably using fine wire plugs."***

We will leave it up to you and your mechanic to decide which is best for your Seabee.

Massive Electrode

Fine Wire

Cleaning/Gapping

Cleaning should be done with a blast of cleaning agent (fine glass beads or ground up Walnut shells) and inspected for any debris inside the plug after cleaning. You may notice lead buildup inside the spark plug. A dental pick or electric vibrating cleaner makes short work of this. Once cleaned, the plugs should be gapped to the correct value indicated in the engine manual. The plug manufacturer can also give you a gap to use. Usually there is a go-no go value to the gap (i.e., .018"-.022" range). The small wire gauge should be able to go around the center electrode but the larger one will not.

One test that is sometimes overlooked is the resistance check. Most spark plugs today have resistors in them. The resistor mitigates the radio or headset radio noise that the spark makes. Normal resistance is between 1000 and 1500 Ohms between the inside of the plug to the center electrode on the business end. Anything over 5000 Ohms and the plug is no good, throw it away.

Gapping tools

Usually the gap in the plug will get larger with time. Using the feeler gauge (red thing above) check the gap in each side of the massive electrode with the correct wire gauge for your plugs. If the gap is too large, attach the gapping tool (round silver thing above) and squeeze the gap until it is within limits shown in your engine manual. If the gap is too small, pry the electrode(s) open with the pry bar (silver "pen" above). When the gap is correct, check the overall wear of the massive plug electrodes with the rectangular gauge (shown above). Place the gauge over the electrodes and if the large circle can go around the electrodes, throw the plug away and use a new one. Place the plug back in the caddy when completed.

Other gapping tools are available so the above photo may not be representative of your tools but the functions of them should be similar.

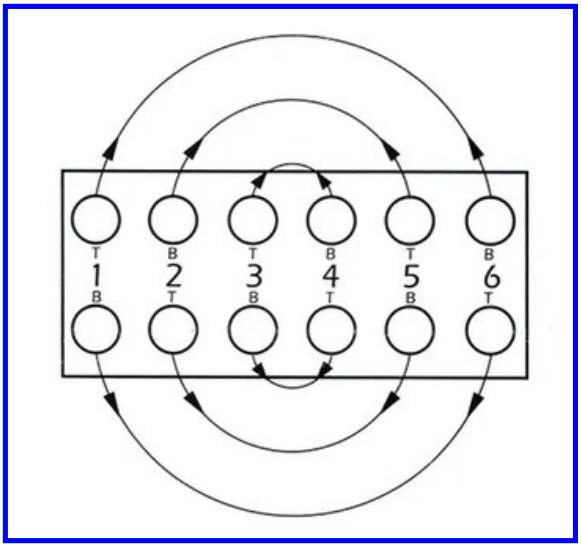
The final test is done with a spark plug tester if you have access to one. The tester generates a spark to each plug, usually two at a time, under pressure. The spark will be brighter and presumably stronger under pressure. If it doesn't spark 86 it!

Rotating

Once the plugs are cleaned and gapped, rotate the plugs in the caddy like this:

Note: Plugs are rotated to allow the plugs to wear evenly. Top (Forward) plugs to bottom (Aft) position of opposite cylinders. Bottom (Aft) plugs to top (Forward) of opposite cylinder.

Franklin positions:
T = Forward
B = Aft



Plug preparation

If the copper gaskets are still installed on each plug, remove them and throw them away. Install a new gasket on each plug; or better yet, anneal the old ones and use them again. You must use a propane torch and with the gasket hanging from a piece of small (.020") safety wire heat it with the torch until it is cherry red. Let it cool and it will be ready to use again unless it is deformed in some way.

Apply the anti-seize compound on each plug. Apply it below the second thread of the plug all the way around the threads. It doesn't take much; just enough to coat the threads. This will prevent seizing (duh!) and make it easier to remove next time.

Installation

Take the caddy with the newly restored plugs to your Seabee. Get the plug socket and torque wrench ready. Install each plug by hand as far into the cylinder as possible. If it is difficult to get the plug started, you may need a thread chaser. Don't use a tap! Thread chasers are better at cleaning out the threads. Tighten the plug with the toque wrench until the proper torque is achieved with a "click" or "beep". Usually 35 ft-lbs and click it again to make sure.

Use the Dow-Corning #4 and put a small amount on the end of the insulator spring. This will prevent corrosion and facilitate electrical current transmission to the plug. Place the ignition wire end into the top of the plug by hand then tighten the nut just enough to prevent vibration from loosening the nut. They are usually aluminum so no torque value is needed nor wanted. For the purists, 7-8 ft-lbs is all. You should not be able to remove the nut by hand.

Dow Corning #4

Final words

If you have followed these instructions you're good to go until next Annual or 100-hour inspection! Take your Seabee outside and start the engine and check that everything is okay. The magneto check should be within limits (about 50 RPM drop but no more than 150 RPM drop). If you have an engine monitoring system the EGTs should **rise** when each magneto is checked. If the RPM drop is excessive, check the timing; that's another story. Make a logbook entry and enjoy an adult beverage.

Fly safe!

***Ed Note**: The Seabee Club wishes to thank Club member Kevin Alquist (A&P) for editing and contributing to this article, thanks Kevin,*