

KOEHLER KORNER

I was working on an RV-10 the other day and we set up to do a compression check. After running the engine enough to get the oil up to about 180 and the cylinders around 300, we shut it down and began removing the top spark plugs for a compression test. After getting the ignition leads off (and only slightly burning my fingers), I attempted to remove the #1 spark plug (forward right side on a Lycoming IO-540). My little 3/8 drive ratchet handle would not budge the plug, even when I hit it with the heel of my hand! The rest of the story is this month's KK.

To get the plug out, I went for some heavy duty equipment. The 1/2 inch drive socket system came out, but with the 1/2 drive ratchet, I still could not break the plug loose! I have a longer "breaker" bar in 1/2 inch drive, but even longer is my old bending beam type torque wrench. Besides, I was now interested in just how much torque it would take to remove the plug.

At about 60 foot-pounds of torque the plug finally released and I gently removed it, carefully inspecting for any damage to the plug hole threads which were heli-coiled with stainless steel, or the top of the cylinder for cracks or the plug itself for damage. The only real issue I found was the highly extruded and flattened copper washer under the plug. Look carefully at this picture at the front right plug and you can see the flange that has been extruded into the inner diameter of the washer. This plug was grossly over torqued.



I shifted over to the next cylinder (#2), and found it to also be over torqued, but not so badly as #1. It broke loose at about 45 foot-pounds. The rest of the plugs came out normally at about 35 foot-pounds.

A quick chat with the owner indicated that the person installing the plugs “borrowed” a torque wrench from a friend and it was not set up correctly. It was a click type which I have found in the past to be notoriously bad at maintaining accuracy. Many years ago I had access to a torque wrench tester from the A&P School where I taught. I brought it preannounced to a Ch. 186 meeting and we tested about 40 click-type Torque wrenches brought in by Chapter members. On initial testing about half failed! Of those that failed, most were clicking a way above the selected torque. We found that by exercising the wrench multiple times (clicking) a bit more than half came back into a workable range (within 10%), but at least 20% of the wrenches were not usable!

The moral of the story here is to have your torque wrench calibrated and then keep it clean in its case preferably all in a zip lock bag, and test it or at least exercise it about ten times prior to actually using it for real. A good way to test the wrench is to put the drive head (3/8 or 1/2”) in a vise and pull at the middle of the handle with a fish scale. The math is the length of the lever arm (center of the hand grip area) in feet times the pull value in pounds. Let’s do a calibration example: If the middle of the grip to the drive head is 9” and you pull with the fish scale to 20 # to get the torque wrench to click, then $9''/(12'' \text{ per ft}) \times 20\text{lb} = 15 \text{ ft-lb}$. Set the wrench for 15 ft-lb, and do the test and determine if it is in calibration. Ideally, do the test at the same torque setting as the item for which you are going to torque, but in practicality you can probably not pull much more than about 40 pounds on a fish scale, or about 30 ft-lb in this example. For aviation spark plugs on a Lycoming they should be torqued between 30 and 35 ft-lb. On a Continental, the spark plug torque is 25 to 30. If you have inserts for automotive plugs, or have another brand engine, check the specific torque. In my experience, they are all less than on a Lycoming.

One more little thought. Always put in spark plugs with an anti-seize. There are several and most folk use too much, but all are better than none. I have never had to replace a washer unless it has been damaged, as in this case. If you use a torque wrench, you will not harden the washer sufficient for it having to be replaced. Yes, I know, the guys that manufacture the copper spark plug gaskets recommend you put in a new one every time, and they do not cost a lot, but in 40 years of torqueing spark plugs, I have never had a reused washer fail in any way.

One last thought, rather than a click-type torque wrench, use a bending beam type. They are harder to use and need some technique, but they do not go out of calibration like a click-type can.

I hope this discussion of basic spark plug maintenance and torqueing will help you more successfully maintain and fly your plane.

Keep building, flying, and maintaining.

Dick

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