PISTON PIN BUSHING FAILURE

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TEXTRON CESSNA MEL-79-01

By now many of you are aware of Textron/Cessna's April 22 release of a new Mandatory Service Letter (SL), Textron MEL-79-01. This Service Letter addresses the failure of piston pin bushings in Continental Aerospace engine equipped aircraft, but it is basically a re-notification of Continental Aerospace's Critical Service Bulletin, CSB07-01A which was originally issued in 2007 and revised in 2020. These re-notifications by Textron/Cessna typically occur when a prime supplier issues a service notice on a product that is potentially installed in a Textron aircraft.

Textron MEL-79-01, (accompanied by its single engine version SEL-79-03) is a rather unique SL for several reasons:

First, it incorporates aircraft models from both Beechcraft and Cessna in one document, further combining the brands under the umbrella of Wichita-based Textron Aviation, Inc.

The second unique feature is the vast number of aircraft that the SL applies to. If the aircraft is a twin engine or single engine Cessna or Beechcraft with a Continental engine installed on it, then these bulletins apply to it.

Continental Aerospace CSB07-01A

Now let's look at Continental Aerospace CSB07-01A. What is it all about?

Connecting Rod Bushing Design: At its upper end, the connecting rod has a press fit bushing installed for the piston pin to pass through. This bushing has a steel shell with a bronze coating on the ID (inner diameter) where the piston pin rides. The bushing is split full-length to allow it to be pressed into the connecting rod and is retained by natural expansion tension after installation.

The bushing is a single piece, running the full width of the connecting rod, and ends flush at both edge facings of the connecting rod piston pin end.

After installation, the bronze portion of the bushing (ID) is then reamed for the piston pin slip fit. This arrangement allows the piston pin to stay reasonably fixed in the piston and the rotational motion of the connecting rod/piston pin happening at the connecting rod to piston pin interface through this bushing. Lubrication is from engine oil by spray and/or splash.

This design is not unusual and has been used in millions of various types of engines for over a century, including every avgas-burning Continental engine with horizontally opposed cylinders.

So, what is the problem?

It has been determined that in some engines the bushing is moving laterally in the connecting rod and starting to extrude beyond one end of the rod. The extruded portion of the bushing becomes unsupported by the connecting rod and some edge pieces simply begin to break off.

Migration from the connecting rods and breakage of the piston pin bushings has been occurring for a long time. In 2007 (3/19/2007) Continental released the original issuance of Service Bulletin SB07-1, stating that they were seeing the problem in returned core engines with some other instances being reported from the field. Before the SB was released, I had the dubious distinction of being one of the first to find piston pin bushing pieces during a 421C engine oil change.

The original bulletin, as well as the recent revision, offers no explanation as to the cause of the problem. Some of the usual causes like material deficiencies, pilot operational procedures, and mechanical work, were never offered as a potential cause. However, in the original 2007 bulletin Continental changed the bushing split line orientation clocking angle for installation (in Fig. 3) suggesting there may have been

Above: Broken bushing on a 421C. Large pieces like this are usually found in the oil sump.
Left: Picture from CSB07-01A.

at least some bushing installation problems. Oddly, this information was not brought forward into the later Rev. (A) bulletin.

Who does it affect and when?

This issue affects every horizontally opposed avgas model engine Continental makes, regardless of model number, serial number, when it was overhauled, or at this point even if it is a new engine. Own a Cub with a C65 and it applies. Buy a brand-new Cirrus SR22T and it also applies. And of course, it applies to every Twin Cessna ever built unless it's been modified with a turbine, Lycoming, or a Mr. Fusion mod.

Why the new release and increased emphasis on this problem?

In the ensuing 14 years since the initial release of SB07-01, random instances of broken connecting rod bushings have continued to occur. At our shop we've seen at least several dozen occurrences during this time frame. We typically discover the problem during oil changes (when a piece of the bushing falls out of the sump) or during a cylinder removal

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for other reasons.

Then, in September 2019, a Cirrus SR22 experienced a total inflight engine failure about 10 miles southeast of Ft. Wayne, IN. The pilot deployed the Cirrus Airframe Parachute System (CAPS) and came to rest with no occupant injuries in a back yard. (see NTSB docket https://data.ntsb.gov/Docket?ProjectID=100263)

The tear down inspection of the engine revealed heavy damage to the #1 connecting rod at the piston end, as well as the crankshaft connection, which caused separation. The #1 rod caused massive internal engine damage once it became unsupported. During examination it was also found that the #6 piston pin bushing had migrated from the connecting rod.

Another picture from CSB07-01A showing how a magnetic drain plug can capture a bushing fragment.

Prior to the engine failure the aircraft had made an enroute precautionary landing due to low indicated oil pressure at which time the oil quantity was checked, and minor adjustment of the oil pressure relief valve was made. The Cirrus departed but complete engine failure occurred 20 minutes later.

Release of CSB07-01A

With heavy NTSB involvement and a reasonably intact engine to examine (due to the CAPS deployment) a good bit of investigation took place. The analysis led to piston pin bushing migration as the "smoking gun." Continental Aerospace subsequently released the rewritten CSB07-01A just a year after the accident in Sep 2020.

With the release of the newer bulletin, Continental also elevated the criticality of the original, standard Service Bulletin (SB07-1) Category 3, to the revision "A" classification of a Category 2 Critical Service Bulletin. While there is no indication that this is going to be elevated to an Airworthiness Directive, this status revision does structure the bulletin into a format that could support an AD Note IF the FAA chooses to release one at a later date.

What do I need to do? (READ THIS IF NOTHING ELSE!)

At this point nothing can be done to mitigate the issue except to monitor the engine for the tell-tale metal pieces of the bushing failure. This can be done as follows:

1) At any cylinder removal event, complete a detailed inspection of all visible areas for signs of piston pin bushing migration or edge chipping on the removed cylinder as well as any other observable rod ends.

I also suggest at this time to "go fishing." Using a clean magnet, probe around in as much of the bottom of the oil pan as is accessible, looking for magnetic pieces. The bushing backs are steel and are highly magnetic. Some pieces could simply be stuck in the grease-like muck in the bottom of the oil pan and this procedure might help you retrieve one.

2) During each and every scheduled oil change, strain the dumped oil through a fine mesh screen (Continental says 1000 microns .040" or less) and look for any pieces. Piston pin bushing pieces typically are rather large chunks and/or large pieces that are curved and resemble the lower fourth of a thumbnail. They are magnetic but a larger piece will show the bronze coating on one side.

This step is important. Every one of the pieces that I have found in engines during oil changes has been identified in the dumped oil. The broken off pieces are quite large and in all cases the oil filter showed no unusual contamination. Also, this has almost never been identified with oil analysis reporting due, again, to the pieces just simply being too large.

Oil Quick Drains

My strong feeling is that if your engines have quick drain oil sump valves — get rid of them. The quick drain opening is really not large enough to allow these large particles to pass through, be captured, and identified. Over the years I have seen lots of large, critical, pieces of internal engine parts simply "plunk out" while draining the oil of an otherwise perfectly operating engine in which there were no other worrisome signs or issues.

Another point that CSB07-01A makes is that there is a strong argument for installation of a magnetic drain plug in lieu of the standard plug. NOTE: The correct part number for the magnetic drain plug for all IO-470, IO-520, IO-550, TSIO-520, GTSIO-520 engines installed in the Twin Cessna is #636376.

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Conclusion

The only action step here is to heighten awareness during oil changes and the inspection phase of normal engine maintenance. You can put a parachute on an airplane, but that won't keep the engine from quitting if you lose a big enough chunk of the piston pin bushing.