Q&A

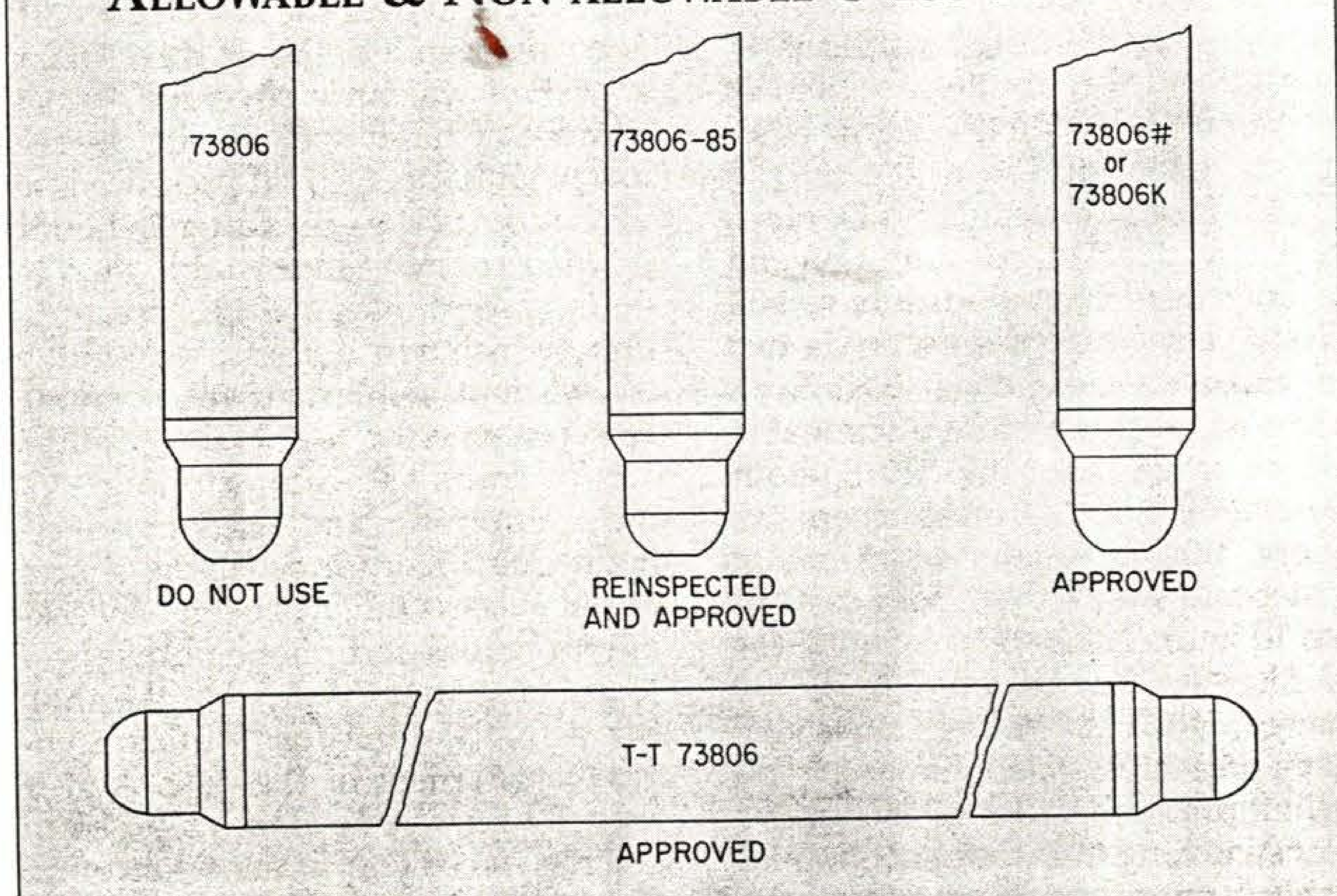
My partner and I are longtime subscribers to LPM and are hoping you can help with a problem that has cropped up rather suddenly. It concerns a 1976 Cessna T210 in which a zero-time factory-reman Continental TSIO-520-R was installed 150 hours ago. Recently, a seepage below cylinder number five caused us to suspect a cracked cylinder. The factory authorized pulling the cylinder for inspection, which revealed no cracks, but there was a gasket-conformity problem due to surface irregularities. While the cylinder was off, we decided to remove the piston for further inspection and found the piston pin bushing (in the rod) significantly worn and chipping away at the front edge, almost halfway around the circumference, with the chips creeping toward the center of the bushing surface. (A classic spalling situation.) We wonder: Should we pull the remaining cylinders now and check the piston pin bushings, or simply replace the rod and bushing on cylinder number five? (In other words, is this bushing problem a fluke, or might it be common to the other jugs?) Also, what damage might have been done from bushing metal having passed through the engine? In the scheme of things, the quantity of metal here may not be all that significant, but finding damage like this always raises the question of whether the case should be split. Given the fact that some metal has presumably traveled around the engine already as a result of this defective bushing, should Continental replace the entire engine with a new zero-time engine under warranty?—G.B., CA

You made no mention of filter or screen contents. Obviously the first thing to do would be to pull the pressure screen and/or oil filter element and look for copper-tinged bits of metal. Also, the prop governor gasket has a screen built into it; examine this gasket for metal. (It's worth sending an oil sample off for analysis, as well. If copper and/or other metals are offscale-high, you'll have positive confirmation of a serious problem warranting complete engine disassembly.) Since you will obviously be taking the number-five connecting rod off, it would be a good idea at this time to inspect both halves of the rod bearing to see if metal particles traveled throughout the oil system and wound up embedded in the bearings. If the number-five rod cap bearing contains embedded particles, you can assume that your main bearings are contaminated, too, at which point a teardown is definitely in order.

Normally we'd tell you to take the other five cylinders off, and/or overhaul the engine. But frankly, given the age of the engine (150 hours SFRM), we think it's Continental's problem, and they should be happy to take the engine back. If you are outside the normal six-month full-coverage period of your warranty, they may well want to clip you for pro-rata costs on the replacement engine; that's standard policy. (Even so, they should offer you some labor allowance.) We feel the chances of a fair settlement with Continental are good. You certainly ought to press for a replacement engine, since it would be foolish for TCM—from a liability standpoint, if nothing else—not to want the defective engine back.

If Continental *won't* take the engine back, let us know so we can tell the world. In any event, don't fly the engine until some fairly extensive checking has been done to see that metal hasn't migrated throughout the oil system.

Allowable & Non-allowable O-235 Pushrods



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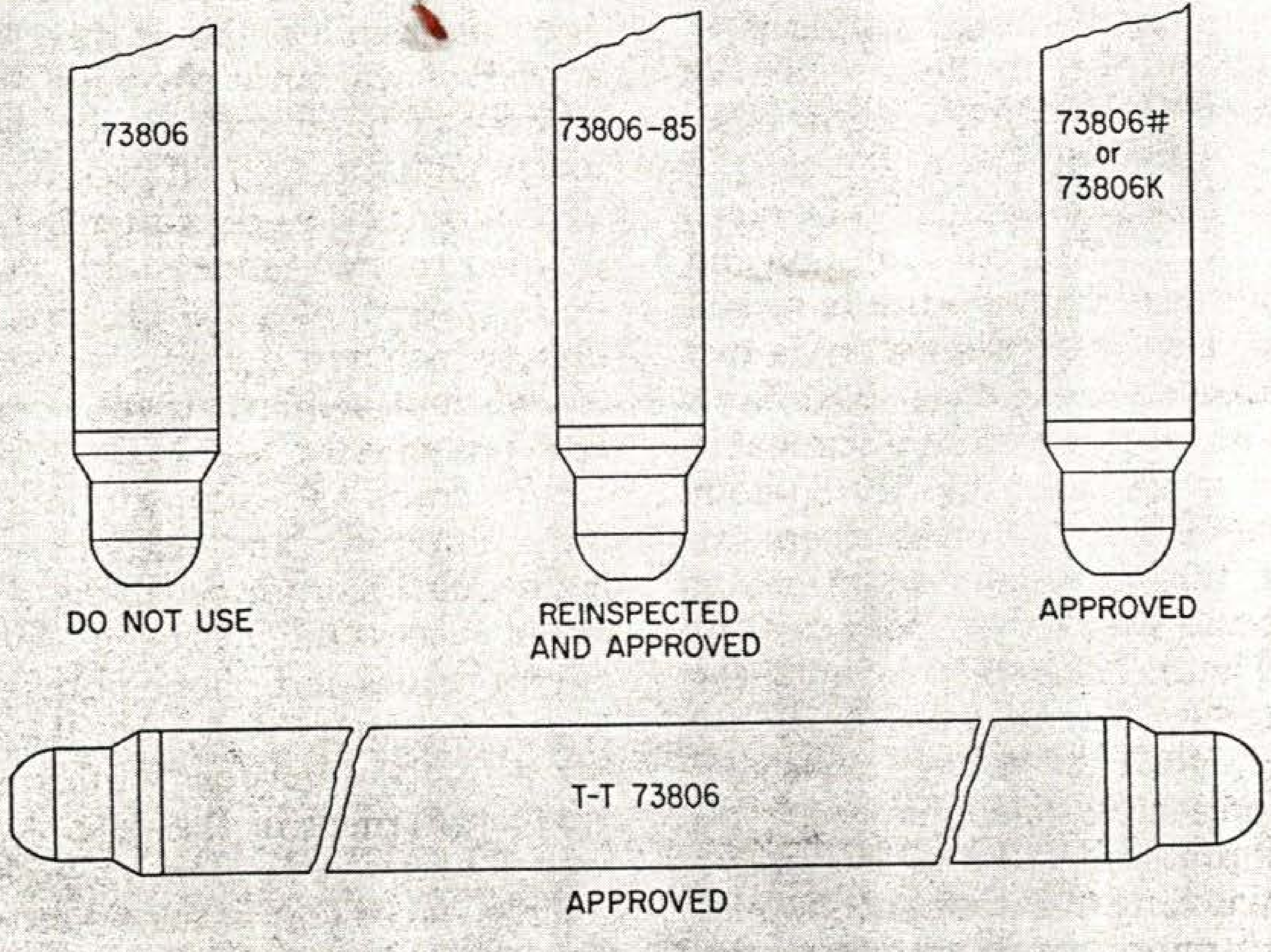

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the compression seemed very low. After running the engine for two hours, a differential compression test revealed 76-78-78-79 (over 80). Still, the engine seems to produce considerably less than 100-hp, and when the prop is pulled through, it will spin as many as three times on one pull. I do not understand how the engine can have compression in the high 70s, yet still have no apparent compression when pulled through by hand. Furthermore, during the four hours I've put on the engine, it seems to run very lean, even though I was running at full-rich mixture, and power output seems poor. Could it possibly be a cam-timing problem?—R.F., AK

It could conceivably be a one-tooth-off mismesh of the cam gear with the crankshaft gear; this can certainly cause the lean behavior and poor power output. But the more likely explanation, in your case, is excessive valve lash. (See further below.)

Before we start jumping to conclusions, you should be aware that the original O-235-C was certified for 100-hp, at 2,450 rpm (at sea level); ignition timing was originally set at 15 degrees before top center (BTC). With 25-degree-BTC timing, the engine is a -C1 and should put out 108 hp at 2,600 or 115 hp at 2,800 rpm. All -C variants of the O-235 use a super-low-compression (6.75:1) piston, significantly different from the 8.5:1 piston used in the -L2C. The low-compression P/N 73851 piston (and, of course, the diminuitive size of the cylinders) is what makes your engine easy to turn over by hand. There is nothing wrong with an O-235-C that is easy to crank by hand. It was designed that way. (If you had an O-320-H that turned that easily, it'd be another story!)

Poor power output is a typical complaint for the O-235 series. Once things like bad mag timing (internal and external), dirty plugs, carb heat door leaking, etc. have been ruled out, the differential diagnosis usually proceeds with a check of valve lash and a visual examination of the pushrods. The O-235 is a solid-tappet engine (one of very few in aviation, thankfully) and has had fleetwide problems with shortening of P/N 73806 pushrods, which leads to increased valve hammering, increased lash, more hammering, more lash, etc. The thing to do is check valve lash every 100 hours and record the measurements, so that a trend line can be developed. Do this now. The tappet clearance (for *any* O-235 engine) should be .006 to .012-in. on a *hot engine.* (It may be as much as .009-in. cold.) If any lash measurement is in excess of .022-in. (hot), remove the pushrod(s) in question.

It may not be a bad idea to remove all of your pushrods and measure their lengths. (Caution: Label each one carefully on removal, so you can later be sure to put it back in the same location.) If any pushrod is less than 11.531 inches long, it shouldn't be. (See Lycoming Service Instruction No. 1388C.) Also, if any pushrod ever *shrinks* more than .015-in. in 100 hours of operation, you should remove that pushrod and inspect it for wear (length), straightness, and looseness of the ball end. (Again, see S.I. 1388C.) Obviously, any pushrod that has a loose ball end or shows signs of mushrooming or splitting should be trash-canned immediately. (Give it a good blow with a hammer before throwing it out, to make sure nobody digs it out of the trash later and reuses it.)

T210 owner found piston pin bushing disintegration in his low-time factory reman. But is it just a fluke—or indicative of greater problems with the engine?

Note that pushrods simply marked "73806" are no longer considered airworthy (Lycoming S.B. 453B). The proper markings are "73806-85," "73806#," "73806K," or "T-T 73806."

Once you've checked all of the above (including mag timing), and you've adjusted your idle mixture and carb heat door, you should find that the engine is developing normal power. Bear in mind, though, that "normal power" for your engine is only 100-hp and will not be noticeably different from the power given by a Continental C-90, particularly if the choice of prop pitch is poor.

I am having a problem with engine roughness at full throttle in my Aeronca Sedan, which is powered by a Continental O-300-D. Rpms above 2,500 cause roughness when continued for a couple of minutes. The engine will stumble as though it would quit (at which time I back off on the throttle!), and carb heat and releaning the mixture cause no improvement. We've been through it as far as compression, carb gas lines, exhaust system, timing, valve springs, float level, screens, plugs, etc. All check good. I have a six-probe EGT system (numeric readout) and the only thing I can find is that on advancing the throttle from 2,400 to 2,500 rpm, I see all EGTs increasing except the No. 4 and No. 6 EGTs, which actually go down. (I am enclosing some EGT data, taken at 3,000 feet and 35 F degrees OAT.) As you can see, No. 6 cylinder goes from 1130 to 1120 F when full throttle is applied, while No. 5, for example, goes from 1250 to 1420. I tried carb heat and leaning during the rough periods, with no improvement. Any ideas?—H.E., MN

We're surprised that no cylinder's EGT goes offscale-low. (It's unusual for an engine to run very rough without a clearcut indication of trouble on a multiprobe EGT. Unusual, but not unheard of, obviously.) We'd caution you not to try to read too much into the fact that some EGTs go and, and some down, during application of the last inch or so of throttle. This is the region of power enrichment, and funny things happen to EGT when the carburetor becomes extra-rich just as the throttle butterfly opens all the way. It's not at all unusual for some cylinders to go up while others go down during application of full throttle, particularly at altitude. (These comments apply mainly to engines with float carburetors. Injected engines tend to show a steady rise of EGT with throttle setting.)

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