

This concerns the very prevalent habit, origin unknown, of placing the mixture(s) in AUTO LEAN while taxiing (one more form of mental masturbation) to "keep it from loading up". I've seen this habit (I really don't know what else to call it) in pilots with every possible level of experience and type of background. Manuals published by the manufacturers, military services and the airlines (and I've looked way back to just before WW II) make no mention of this procedure. Every manual that I can find – without exception – simply calls for RICH after start, then recheck it prior to the takeoff. You'll notice that I've used the word "manual" here, in some cases checklists may be a completely different story! Everyone and his brother seem to have gotten into this act. Contrary to popular belief, a general aviation checklist isn't really examined or looked at for its accuracy by any responsible authority prior to being placed in use. It very easily may be just a list of items by anyone, easily containing one – or more – "old wives' tales". Such is the case of a number of "checklists" I've looked at on some vintage airplanes, this article addresses just one of the more glaring mistakes seen in them. If my aversion to old wives' tales were the only important thing, then I probably couldn't care less. However, this really needs to be addressed as the FLIGHT SAFETY problem that it really is. Sometimes people forget them for run-up but the following is the real problem! I can distinctly remember three times watching pilots get busy, skip them somehow on the before takeoff checklist and then start a takeoff in AUTO LEAN, causing them some amount of embarrassment when I mentioned it as they were advancing the throttles.

I recently acquired an USAF Manual 52-12 (Powerplant Maintenance for Reciprocating Engines) published in 1953. (It's surprising what you sometimes find at estate sales.) In looking through it for a description of how to accomplish an idle mixture check I found something that directly applies to the subject I mentioned in the first paragraph. Quoting from page 182: *"NOTE - On all carburetors, except the Holley Pressure-Type carburetor, effective leaning of the idle mixture will not occur until the mixture control approaches the IDLE CUT-OFF position. On Holley Pressure-Type carburetors, effective leaning of the idle mixture is accomplished between the RICH and LEAN positions as well as between the CRUISING LEAN position and the CUT OFF position."* Everything that I've flown for many, many years has had Bendix-Strombergs. The only Holley around that I'm aware of at this time is the EAA's B-25, although a few others may become known as a result of this article. It would appear that the only person who might offer some sort of an excuse for this might be an old time B-25 pilot from back in the days when (mid-fifties) we had "J" models with Holleys in the USAF. And even then, only if he had a mis-adjusted carburetor. I don't, however, remember ever seeing anyone do it back then – when we still had a lot of those WW II pilots around.

A Bendix carb functions like this. During the first 10° of throttle travel the mixture control plates aren't really in the picture since the airflow at this low

power is not enough to provide a stable idling speed. Instead - back in this idling range – the idle spring contacts the diaphragm poppet valve and holds it partly open, providing a fuel supply deliberately in excess of that required for idle power. This rich flow is then reduced by the idle mixture control valve (manually adjusted with the idle mixture setting screw, more on this later) and enters the engine's induction system. Properly adjusted, this flow will provide a stable idle at a proper fuel / air ratio designed to avoid "loading up". So you can move the mixture control back and forth between RICH and LEAN till the cows come home and – – absolutely nothing happens. I agonized over how to paint a verbal picture of this operation and finally tried to draw a couple of diagrams figuring a picture is worth a thousand words. Bill Harrison thought about this for awhile and reduced it to a simple analogy. If you've got a river bed (flow of fuel) it doesn't make any difference how many dams (mixture plates and jets) you place downstream if everything has to first pass through a little culvert (idle mixture control valve).

While writing this a friend said "why don't you say exactly how you'd perform this idle mixture check". I think I'd be more comfortable telling how most mechanics I've known and talked to over the years seem to want it done since they're the ones who'll have to adjust the idle screw based on the information you provide them from this check.

First, don't just read this and decide to go out and do a check after pulling the airplane out of the hangar and running it for a few minutes. The engine and carb need to be at operating temperature, cleared out and stabilized decently. So, do it after flying it if possible. Find an area on the ramp where you won't have to look outside for a couple of minutes. Run the RPM up to around 1500 for thirty seconds or so to clear it out and then gently close the throttle (remember it's an idle mixture check). During the next step you can save yourself a little time by placing the mixture maybe half way between AUTO LEAN and IDLE CUT OFF. (You could start way up in RICH but it wouldn't accomplish anything, the rise in RPM is going to occur when you get the mixture to a position very near IDLE CUT OFF.) Note the idling RPM. If the tachometer needle jiggles a little bit "average" it in your mind to a specific RPM. Then, slowly start moving the mixture towards IDLE CUT OFF and keep watching the idling RPM. This is kind of like s-q-e-e-z-i-n-g a trigger during target shooting, it should surprise you when something happens. I should mention here that in talking to Steve Hinton he's had good luck with moving the control pretty normally but most manuals describe the slower method. All of a sudden, the RPM will start a "perceptible" rise to reach a peak (best power) and then start dropping towards zero. In the rare event that the RPM doesn't rise at all, you're idling at best power and the idle mixture needs to be enriched slightly. Another thing that I definitely want to include here is an indication favored by many professional mechanics I've talked to. They keep a close eye on the manifold pressure, you should see a drop of about 1/4" while the RPM rises, any more is too rich. At this point you'll probably want to place the mixture back to a running position and catch the engine to

repeat the check, most people need to do so in order to really get a valid or good RPM reading. Or, you can just let it quit if you've seen what you need and are finished.

Let's discuss "perceptible" for just a moment. To me this means that it is a very small amount – but – you are able to perceive it. The maintenance manual on your specific engine should tell you how much is allowed. For instance, reading the USAF B-25 -2 for the R-2600 says a 10 RPM rise is allowable. I've always thought that in general if you see anything beyond a 25 rise it's excessively rich and needs to be adjusted. Before starting to write this I don't remember ever seeing one that would rise much more than 50-75 or so but recently I experienced something that gave me a case of the round eyes. I knew it was excessively rich since it was torching at idle – big time! I casually mentioned that we'd do an idle mixture check before shutdown and we might see something like a 100 rise. In the last little bit (3/4' at the most) of mixture travel towards IDLE CUT OFF I was astounded to see a rise of 250 RPM or more. Absolutely nothing was happening – until that last little bit of travel.

Now, for those of you who've stuck with me this far, let's go back to the first paragraph. I've debated whether to mention this or not. I think I'll have to briefly touch on this since some of the people reading this possess a level of knowledge acquired from working on these carbs or otherwise being an long time observer of aeronautical trivia and will have caught it. Maybe I'll expand on it in some future Warbird Note when there's more space. Whatever, I'm sure that someone will observe the last sentence of the first paragraph and say "even if you did forget and leave the mixtures in AUTO LEAN before takeoff the fuel flow would be enriched by the power enrichment valve and the fuel flow would be the essentially the same as if the mixtures were in AUTO RICH". This is true, the charts show at high power the flows are the same regardless of whether the mixture control is in AUTO LEAN or AUTO RICH. But (and this is a really big but) you're relying on a fifty year old mechanical device within the carb to perform this function. I'm reminded of the pungent observation of a highly experienced old naval aviator whose friendship "Connie" Edwards and I've enjoyed for many years. Art Ward sez, "well, I'm old and sometimes I forget!" Maybe some parts of your carb might also forget, I sure wouldn't want to rely on them in this case. Furthermore, after takeoff just as soon as you retard the throttles to a point where the power enrichment valve closes, you'll be in a detonation range.

I guess that's pretty much wraps up what I wanted to say about this habit. If something's wrong, then fix it! But, if everything's working correctly, why wear out the mechanical components of the fuel system for a paradigm that turned out to be untrue? It sort of makes me think of that old Johnny Cash song, "bad news travels like wildfire, good news travels slow". I've discussed it with some really experienced aviators and they also can't say where it really came from, it just started to happen somehow over the years. Merrill Wien has a plethora of experiences to share, he agrees that we never saw it in years past but

somewhere along the line it started to creep into a lot of procedures. It's amazing how many people cling, almost fanatically and with highly detailed justifications if asked, to this perception in spite of manuals, illustrations and whatever. And this isn't just the inexperienced, it includes people one would expect to know better. Might be enlightening the next time you see someone automatically moving it to AUTO LEAN after start or landing to ask "would you mind sharing with me just exactly why you're doing that?" If the answer is "to keep it from loading up", that'll tell you something about their level of understanding. If this were true then you could see a noticeable difference in the idling RPM when the mixture control is moved between AUTO RICH and AUTO LEAN. As a friend says, this habit has become pervasive and people have honestly felt they were accomplishing something. But just like believing in ghosts and goblins, it's a understanding thing.

P.S. In the interests of trying to make this as technically accurate as possible I should probably add a disclaimer to an earlier paragraph where I said I remember leaning only when I had a improperly adjusted carburetor. When I was sent down to Lloyd Aereo Boliviano to give flight training in the mid-sixties our flight engineers routinely had to manually lean while we taxiied our DC-6Bs at La Paz. "El Alto" airport was at 13,500' MSL, field barometric was about 17" of MP. The idle adjustment for Buenos Aires or Lima at sea level obviously wouldn't work up there on the Bolivian altiplano. We had to lean the mixtures to maybe 1/2" or so short of the IDLE CUT OFF position to keep them running. Putting them in AUTO LEAN accomplished absolutely nothing. At any rate, in this letter I've been talking about normal altitude airports.