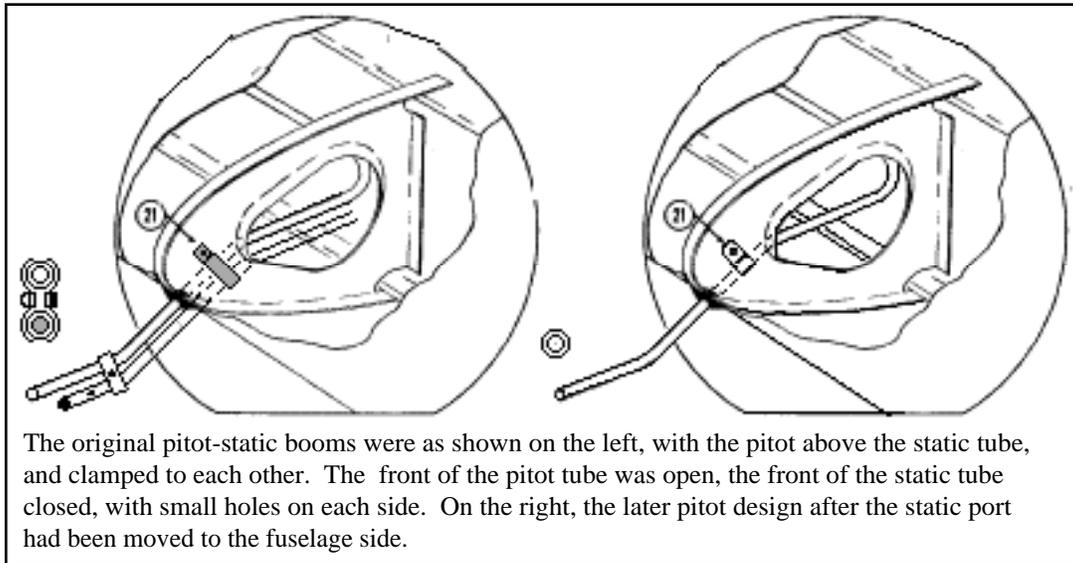


Static System Features, Results, and Symptoms

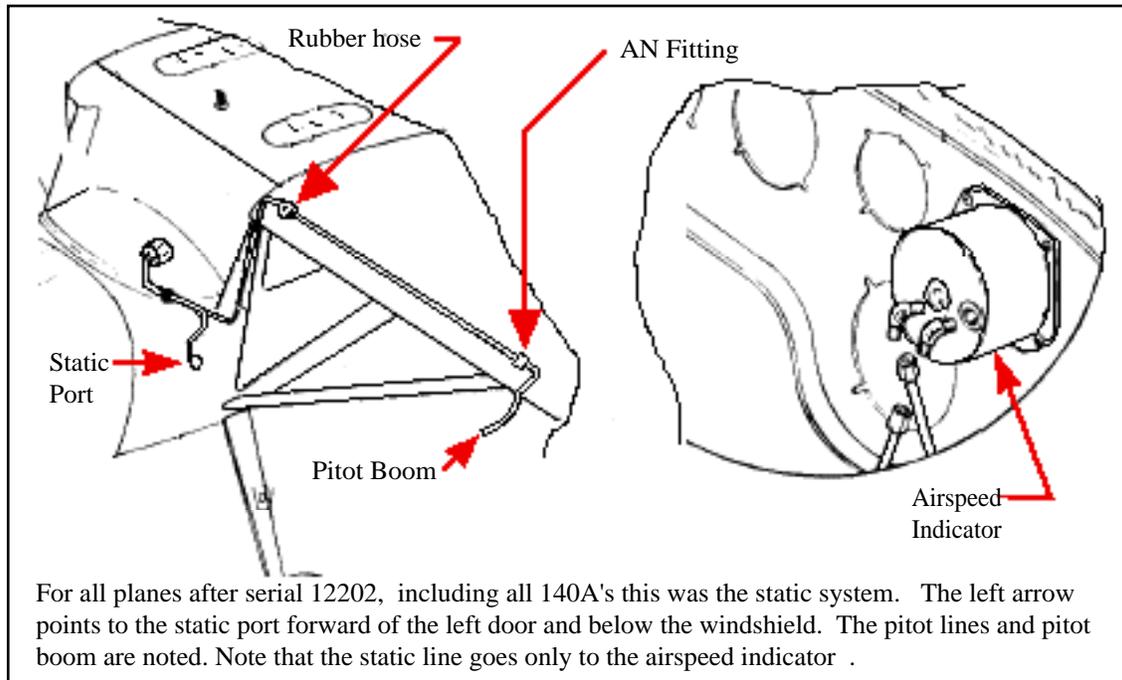
Symptoms:

Symptoms of a faulty static system are erratic indications on one or several instruments. For planes up to serial 12201, the airspeed, rate of climb (ROC or vertical speed indicator, VSI), altimeter and encoder could all be affected because they were usually plumbed into the static system. For planes at 12202 and subsequent, only the airspeed indicator was connected to the static system. The most universally seen symptom is that the airspeed indication is low, often about 85 MPH when cruising. Cessna acknowledged to dealers that often the anomaly could be corrected by opening all but one of the instruments to allow the cabin to be the "static" source.

Static port placement is black magic, often going awry. The first 120/140 planes had two forward-facing tubes on the left wing, with the static closed-end pipe under the pitot port, and the actual static ports were holes on both left and right sides of the static tube. It was expected that the static tube would stay aligned with the centerline of the plane but any tilt away from that can introduce some pressure into the static system and that could cause an error in readings.



The static port was subsequently moved to the left side of the airplane, just forward of the left door and about in line with the bottom hinge as in the next figure. After the change and until the 12201 serial plane, the static system would have been routed to the altimeter, air speed indicator, rate of climb indicator (ROC or VSI if installed) and recently to the encoder. The next figure was taken from the 140A parts manual and the pertinent lines of the figure were accentuated; this shows the routing of the static port only to the air speed indicator for all planes after serial 12202. The relative positions of the two ports is indicated.



It was found that neither the wing-mounted static port or the fuselage location for the port would always provide the correct static pressure to give proper readings on the instruments noted.

For those with the port on the left side, what one of the old-timer FBO's showed his troupe to do was to jimmy the hole with an ice pick, thereby increasing turbulence and providing a more likable pressure. Not surprisingly, that fix was nowhere sanctioned by Cessna, nor did they give hints to owners of how to measure or fix the static conundrum because a sold plane was not their problem.

Cessna did some actual tests (why did their test flight engineers not note the problem?) and the results were sent to all the Cessna dealers, but not to owners. That message can be found in the "letters to Cessna dealers" section of the sites. It is presented here just as written so long ago.

Instrument Static Lines	[1 of 1]Posted:	01-16-2003
Views: 25	March 7, 1947	
General Letter No1 64		
TO: All Distributors & Dealers		
Subject: INSTRUMENT STATIC LINES		
Gentlemen:		
Toward the last at 1946, we ran tests on the accuracy of various instruments when hooked up to the airspeed static line, and also when the static opening on the instruments was vented directly into the cabin. We found that the instruments were actually more accurate without being hooked into the airspeed static line. This arrangement has one additional advantage, namely, the prevention of moisture entry into the instruments through the static line.		
Therefore, beginning with Serial No. 12202, we omitted static lines from all instruments except the airspeed. The other instruments have a plastic fitting, with a hole in it, screwed into the static opening.		
CESSNA AIRCRAFT COMPANY		

The most common symptom that jumps up when something is amiss with the static pressure is that the Air Speed Indicator (ASI) indicates 85 mph or about that at cruise when you are going a bit over hundred. On Climb, about 60/65 instead of the usual 81, and a like offset on approach, which means those souls who put up with it are going much faster than they know when on final and landing. Those who have flown a significant number of hours in the plane develop a feel for the actual status of the plane without looking at the instruments, and they also note the typical sound and fly these indicators when the instruments are telling stories.

The fix? Horrors!!! Break one of the static fittings in the cockpit and watch the ASI jump to 10X and 81 and 65 as they should be. Recent emails have suggested another situation in which all of the instruments are observed to read low right after engine start and stay that way.

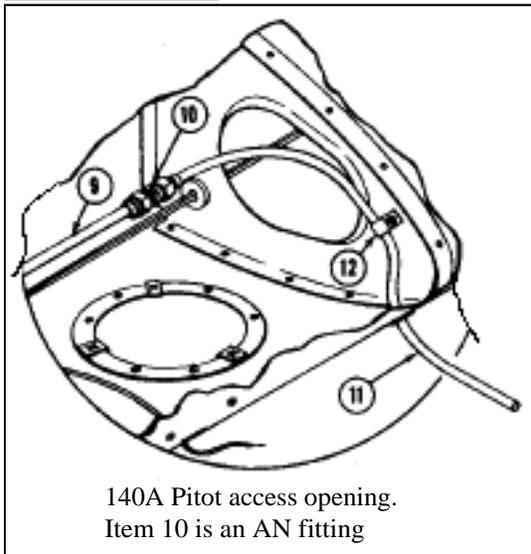
120/140 planes:

Long before the club member brought the Cessna letter to our attention, we had learned the trick of venting the static system to the cabin. I changed mine many years ago and found that readings were more realistic and I left good enough alone. The problem came back when the encoder was tested every two years, but the hose was easily pulled from the slip-on fitting of the encoder and all was good again. On my plane, I have the wing static port and the fuselage port, though the latter is not connected. I found the same thing about using or not using the external port and so the static hose "slips off" the encoder after every encoder/transponder check. This year, I alerted the certified checker so I did not have to disconnect.

In the same fashion, we found in a friend's 140 after his encoder was added that his airspeed was 87 with the static port system reconfigured to include the encoder and just over 100 using cabin static. Climb was 60 with the static port connected and 75 or so with cabin venting. Every time he would have the encoder tested, 87/60/60 and out came the Proto "klik-stop" crescent-like wrench and off came the static fitting to the encoder.

Expect that mechanics who get under the panel and note the disconnected static line will "do you a favor" and reconnect without mentioning it. The people checking the calibration of the encoder on each two year anniversary will often do the same and it can cost you more money and the symptoms of incorrect indications. Have a copy of this or at least the letter from Cessna to justify the disconnect and make the point before that no change is to be made.

Possible Faults:



140A Pitot access opening.
Item 10 is an AN fitting

1. Cracked hoses, especially those in the left armpit which join the tubes from the older pitot-static probes to the tubes which carry the pressures to the instruments; there are two tubes so two rubber hoses and in the newer planes there is only one hose there. In the second drawing, note the connecting hose and also note that there is an AN fitting joining the long tube to the actual curved pitot tube port. Just under the AN fitting, there is an access hole in the wing for the A's for that fitting. Leaky hoses can both let pressure escape and absorb greater pressures.
2. Bugs of course; they like to put an egg or two in small recesses and let the young grow there and leave behind a very effective block against pressure. Careful if you blow out the pitot with high pressure air (always disconnect the pitot at the airspeed indicator).
3. Perturbations of the airstream which have modified the flow over or around the sensing point.

4. And the lesson recently that instruments can leak internally, affecting all other devices plumbed to the same system.

5. Cessna used no vacuum driven instruments on any of the planes so there were no venturis unless mounted after the planes were delivered and no engine mounted vacuum pumps until people started to put O-200 engines in the planes. A significant vacuum system hose leak can affect those instruments open to cabin static.

Email Inputs:

Now late 2005 and new inputs to the site about static oddities, with both of these from 140A owners. My comments are in blue and italicized.

1. On my C-140A I get an error on the airspeed indicator and the altimeter when I start the engine. They both read lower than before the engine start and they progressively get worse on the take-off roll. As I break ground the altimeter is indicating below field elevation and the airspeed is reading lower than actual. I am sure it is a static air problem. The static air system is plumbed as depicted in the parts manual and ported to the outside of the fuselage on the pilots side of the aircraft.

Go back to the figures and note that on all 140A's, the static pressure is plumbed ONLY to the airspeed indicator, so the assessment made has to be incorrect. What appears more likely is that he has a vacuum in the cabin, perhaps created by a leak in the venturi system, or by a door cocked so as to suck. The maker of the bulged windows for, mostly, powerline or gas line patrol, learned that the bulged windows would make the doors bulge as well, from the sideways "lift" they caused, and that reduced pressure would also change the cabin "static" pressure. Unfortunately, the writer did not state if the problem was new or has always been the case. Another respondent stated that if the venturi is too close to the side static port on the left side of the fuselage, the turbulence there could affect it, but go back and look at the figure where it shows that the 140A static is not plumbed to the altimeter. He might have two faults, not one.

2. 140A. I just installed GPS. I timed my climbs on 500' intervals and my VSI (Vertical Speed Indicator or ROC for Rate Of Climb) is way off.

My air speed indicator gives numbers that are close to GPS ground speed (all other factors accounted for) when the static line is vented to the cabin but indicates 10kts lower when plumbed properly to the factory static port. I have not figured that one out yet.

Yes, 87 MPH indicated. The letter from Cessna does not discuss disconnecting static from the airspeed indicator as well, but we have found too many planes where that is necessary, too. It does signal that he has a static problem as he has surmised.

If others have had static pressure symptoms and have different cures, let me know to incorporate in the article.

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filed as Cessna pitot static open revised Sept '05