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Buying a Coupe - a pre-purchase inspection guide

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By Ed Burkhead
Copywrited

Here are guidelines for a pre-purchase inspection. These things would be done if you want to do the job right! Realistically, most people will skip some of these steps even though many items are things the buyer can do him/herself. These things are listed because my advisors suggested that they were ***important***.

As an example, here is a testimonial from another 'Couper considering a purchase....

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[As a pre-purchase inspection,] I went through a real eye opener last week while observing an Annual Inspection on a Coupe that had one a year ago and that an A&P had signed off "all AD's complied with"...

** Brackets for carb collator not done,*
** brackets for muffler not done,*
** corrosion in the wings that I believe that could not of shown up in one year's time*
** hardware store, course thread bolts used at wing attachment points with no wire tie or cotter pins*
** throttle and carb heat cables not anchored down with clamp plates yet the clamp plates were there*
** Many bolts/nuts not wire tied in the engine compartment*
** a supposedly 85 HP engine but the oil dip stick was not marked for 4.5 qts.*
** one mag was loose and could be rotated by hand and throwing oil*
** two exhaust pipe-to-engine gaskets leaking because the nuts were stripped on cylinders 2 and 4*
** this on an engine with less than twenty hours since total rebuild.*
** pilot/owner using mogas without any STC.*
This plane was flown in that morning for the start of the Annual. I could go on and on. Needless to say, I did not buy the plane.

Disclaimer:

Use of this checklist does not guarantee you'll buy a trouble-free aircraft. Not using such a checklist does not guarantee you'll have problems. I've seen at least one person buy a cosmetically good aircraft and, $7,000 later, give it to a museum because it's un-repairable. It's your choice. I am not an aircraft mechanic. I solicited advice from mechanics to build this checklist and asked mechanics to review it so I think it has objective value in your purchase process. I guarantee I would not buy a plane without using this checklist. I strongly advise you and your mechanic go through this check-list and make your own judgments before inspecting and buying an airplane.

AIRFRAME

Tools needed: Differential compression tester and air compressor, flashlight, safety wire and pliers, magneto timing tester, mirror, large crescent wrench, magnet, spark plug socket and ratchet, screwdrivers and metal awl.

1. Check the whole structure for corrosion. If the aircraft is painted, corrosion will cause paint to bubble. If the aircraft is polished, corrosion will be evident by small black spots.

The wing should have inspection panels on bottom side -- if it doesn't have them, beware, the wing could be full of corrosion without anyone knowing it. Don't buy the plane until inspection panels are installed and the wing inspected. Also, according to John Wright, Sr., there could be damage from a previous improper repair that may not even be recorded in the logbook. The accident that prompted service bulletin #27, says John, had two previous repairs made to the left wing. This aircraft had also been severely punished by the owner.

Pull up on wing tips, then down with about 35-50 pounds pressure. Look for looseness at front spar to spar-tip joint -- 3-4 feet from wing tip. (The spar has two parts, the main section and a pointed tip-section -- it is the joint between these that should be checked.) Loose flathead rivets will creak at this joint. Also check wing attach bolts to center section using this pressure method. While assistant is raising and lowering wingtip, put two fingers between spar and bolt at wing attachment point. If loose, the wing will wear the bolts rapidly. Check for open drain holes at the bottom/rear of fabric wings.

2. Corrosion on front wing spar behind wing tanks. They can be inspected by removing the gap covers (between the wing and center section) and inspecting with a mirror and flashlight.

Slight surface corrosion can be treated with ACF 50. Deep corrosion (white powder) is cancer. Find out if aircraft has been hangared or left outside and climate it was exposed to -- be extra cautions about aircraft based in coastal areas or Florida.

Center section behind wing tanks has limited visibility from gap seal opening. Floor board has to come up to see the front side of bottom spar cap and the entire center section of the front spar.

3. Entire fuselage should be inspected for inside corrosion. There is an AD requiring inspection of the center section. This corrosion occurs in just some airplanes - if it occurs in your plane, it could cost you thousands. Usual causes are not defined but probably include mouse pee and/or drain holes not kept clean so water can build up in the belly.

The AD requires you to either remove the wings and inspect with flashlight and mirrors OR make inspection holes and inspect with a borescope. I've heard a Coupe mechanic say he thought an absolutely complete inspection would require both but if either method was done properly, not much should escape. Be sure the plane you are buying has had this inspection done properly, using either method. Worst-case repair situations could be over $5k (as long as used center section parts are available). Most people are finding no corrosion or light, fixable corrosion. Other things to inspect include the tailcone area, elevator and rudder, attaching brackets and bellcranks, bottom and belly when insufficient drain holes are drilled, and around battery box.

4. Inspect control surfaces for corrosion and mis-rigging.

Lower inboard ends of ailerons can collect water (dihedral) Look through this end of aileron with aileron lifted. The bottom of elevator and horizontal stabilizer sometimes corrodes. Look through holes at the rear of the horizontal stabilizer to see rear spar (elevator lifted).

Rudders: Rudders seldom show much corrosion but check bottoms and steel attach fittings to horizontal stabilizer for rust. Push outward on rudders listening for cracking/snapping noise in rudder spars (see AD 59-05-04).

Check elevator up travel to specs using drilled hole in rudders. 415C, CD, D, E are different as is Forney, Alon, Mooney. On rudder, lay out line at right angles to leading edge of rudder from point midway between attaching bolts of center hinge, and running to rudder trailing edge. From intersection of this line and rudder trailing edge, measure up or downward to find travel of elevator. See if it looks close for pre-purchase inspection, then get rigging re-done when you can. It'll take about eight hours or so for someone who know what he's doing to re-rig the plane, assuming you don't have to replace parts.

Elevator:
415-C: up 13° down 12° (3.25" up ±.25", 2.88" down ±.5")
415-D: up 9° down 12° (2.2" up ±.25", 2.88" down ±.5")
415-E,G Forney F-, F-1A, Alon A-2, A2-A: up 20° down 10° (4.9" up, 2.5" down)
M-10: up 25°-24° down 32°-36°

Trim:
415-C: up ? down ?
415-D: up 0° down 60°
415-E,G Forney F-1, F-1A, Alon A-2, A2-A: up 10° down 36°
M-10 up 7°-10° down 32°-36°

5. Inspect aileron control rods for corrosion. Use a sharply pointed tool (like an ice pick) to poke at the surface of the rod, especially in the last few inches near the ends. If the tool pokes through, the rod has probably rusted through from the inside out. One inside rod can probably be replaced for less than $100 but you will have to remove the wings. The short rods, between the center section and the wings, only cost about $45 and are pretty easy to replace. If you replace a rod, make the new rod the same length as the old one before installation, then check the rigging after installation. Especially check under battery box where right/hand aileron control rod passes through.

6. Check control rods for excessive play. Have someone hold the aileron firmly next to the center section on one side of the airplane while you lift and lower the aileron on the other side. Play should not exceed 5/16" at wing root (7/16" if the original aileron counterweights are still installed).

If play is excessive, it could be many things causing it: worn rod ends, control column bearings, upper quadrant bolt loose or worn, mixer box bearings or shaft worn, bicycle chain on control column loose or the bearings in wing root bellcrank. These are some of the common problems in some aircraft -- if all are bad, it could be many dollars to fix.

Check for dry heim joints (rod end bearings) for lack of lubrication.
Check rigging -- when ailerons are faired at wing root (on both sides, steering wheels should be straight (use straight edge on bottoms of wheels) the nose gear should be straight and the rudders should both be straight.

7. Check control wheels for excessive play.

Control mast chains must not be loose or to tight -- just parallel to horizontal travel (i.e. no sag). Universal joints on steering shafts should be tight -- control wheels should not have more than 1/4" rotational play if U joints and chains are correct. Front landing gear pushrod should have no more than 1/32" play at joints and steering total play should be no more than 1/16" from control wheels to nose wheel or vibration will occur.

Cables at top of control mast break strands where they make tight turn from quadrant -- AD 54-26-02 (annual). Not required with new type quadrant & cables. A member recently had one of these cables break (on the ground, fortunately).

Especially be sure that the chain is in good condition and that the master link is safety wired and firmly in place. Worst stress on control assemblies comes when attempting to rotate them when plane is stationary. New universal couplings are $20 each.

Failure of these components would be life-threatening.

8. Look for fuel tank leaks or evidence of fuel stains on bottom of tanks. It's easier to see stains if 80 octane has been used.

Look for auto fuel usage and wrong Randolph sloshing compound used. Look into tanks with a flashlight for white, not brown, sloshing compound or no sloshing compound. Look for floating specks of stuff in the gascolator and drained fuel.

9. Inspect nose bowl and cowling for cracks, missing fasteners, etc.

Inspect top cowling supports that attach at top engine mount/firewall bolts to lateral top supports for cracks near weld joints.

Is stainless steel skin over fuselage tank on planes claiming to be model "D" or "E" but whose serial number is 4423 or below? (All planes serial # 4424 and up should already have stainless steel over the tank.

PROPELLER AND ENGINE

1. Inspect prop for nicks. Check tracking of the propeller and look for evidence of abuse. Check propeller for straightness by sighting along leading edge.

Also check the prop and logbooks against the type certificate (available from Univair: book id: ESS, price $9.00). It could be costly if it is illegal and some picky IA finds it.

Check pitch as stamped on front of prop hub. Spinner must be removed. Static RPM is controlled by prop pitch. Is proper length prop installed? (Note: polished props are vulnerable to corrosion unless kept waxed.)

2. Check spinner for damage by applying light pressure up and down. Spinner should not be loose. Single attachment plate spinners are more likely to crack than double attachment plate spinners. Back plate usually cracks first. Prop

must be removed to properly inspect backplate. John Wright, Sr., says, "Single plate spinners should be outlawed, in my opinion. I have seen many of the back plates cracked and there is really not a good way to check them without pulling the prop. I have seen them crack with as low as 35 hours on them."

3. Compression test of engine should be OK. Normal compression of good C-75, C-85, C-90, O-200 engines is 72/80. Less than 60/80 is reject -- usually bad exhaust valve or stuck rings.

Pull oil screen -- look for metal particles (flakes) that can be removed with a magnet -- indicates camshaft or piston ring wear. Bronze particles indicate exhaust valve guide wear, dark aluminum indicates bearing (rods, mains) wear.

If a cylinder is low, listen at the exhaust. If you hear hissing, it is the exhaust valve. If hissing is heard at the carburetor air filter, it is the intake valve. If it is heard at the crankcase breather tube, it is going past the piston rings. Valves or valve guides could be worn or it could be broken piston rings. It could cost many bucks for this job.

4. Engine compartment should be inspected for excessive oil leaks, condition of exhaust system, hoses, wiring, etc.

"Oil leaks should be found," says John Wright, Sr. "Small leaks are common. C-85 Continentals are kind of like a Harley Davidson, if there is no oil leaking out of it, it probably doesn't have any in it. However, I had two engines with persistent leaks -- one had a cracked cylinder barrel, the other had a cracked crankcase."

Check baffling and baffling seals, hot spots (brown) on cylinders indicate cracking. Check engine mount for bent tubes which indicate hard landing on nose gear. Check hours since major or top overhaul time on mags, generator, starter, exhaust gaskets for leaking, loose muffler or carb heat muff.

Is gascolator double bracket installed? (Must have two brackets from gascolator to engine to brace the gascolator from vibrational breakage. AD.)

Exhaust muffler outlet pipe should have stabilizing support to some point on engine (not engine mount). Connections to exhaust pipes are insufficient to retard pendulum effect of outlet pipe.

ENGINE START

1. Engine should start within 3 or 4 revolutions.
Mags off -- turn prop over to hear both impulse couplings snap.

2. Starter should not make any abnormal noise. Some noise is normal because the Coupe has a reduction gear starter. Check adjustment of pinion and cable. Harsh noises indicate Bendix clutch is near failure. Grinding or grating noise could be bad starter bushings or bad teeth on the gears.

3. Oil pressure should be up within 30 seconds. 45 PSI cold engine indicates good pressure. (In cold weather, a car dipstick heater in the oil tank may warm the oil enough that the pressure can come up in 3-4 seconds. (P.S. Heaters can be obtained at Western Auto for $10.)

4. Generator or alternator should have good initial charge rate. 1500 rpm and 20 amp generator should charge 10-14 amps for short time -- turn on all accessories -- charge rate must be above 0 amps when flying at cruise rpm. 12 amp generator charges 5-10 amps initially. See AD 47-20-09. The initial rate depends on battery condition and how long it took to start. Charging rate also depends on rpm. A generator doesn't come on line until 1300-1400 rpm and doesn't put out full power till 1800-2000+ rpm. An alternator will come on line at idle rpm and will put out full capacity at about 1000-1100 rpm.

ENGINE RUNUP

1. Mag check should be done at 1500 rpm for C-75 or C-85 and at 1800 rpm for C-90 or O-200. An rpm drop of 50 to 75 rpm is normal. Make sure each mag drops -- if one does not drop, the mag switch could be inoperative and you wouldn't know it otherwise.

2. Check carburetor heat at same rpm -- rpm should drop 75° to 100°. This is a go/no-go situation -- if it does not drop, the carb heat is not working and the aircraft should not be flown. Very dangerous is a partially-on carb heat condition which could cause icing.

3. Static rpm should be checked as correct depending on prop and pitch.

4. Check oil pressure and oil temperature during runup. Values for oil pressure should be in green range on gauge. Oil temperature should be 75 degrees F before takeoff to ensure proper oiling (spray of pistons and camshaft, especially under full power.

Oil pressure should be steady and not fluctuate.

TAXI TEST

1. Brakes should stop plane reasonably well if Goodyears and very well if Cleveland. Brakes should hold plane against thrust up to full power -- be careful if you test this that you don't suck gravel up to damage the propeller or overheat the engine. Find a spot of clean pavement or good grass.

Cleveland linings are easy to visually inspect for wear -- if they are less than 1/8" thick, replace them.

Goodyear brakes require wheel and disc removal. If Goodyear brakes are installed, be sure to check disks and the buttons and clips that hold the disks in place. This has been a problem in the past in that the buttons fall out causing the disk to cock and lock the wheel.

2. Plane should taxi straight with control wheel in the center (under no wind conditions). There shouldn't be excessive play in the steering wheel. If play is excessive, refer to paragraphs 6 & 7 of airframe inspection section.

FLIGHT TEST

1. Test all radios and avionics gear to be sure they really work, that radios receive, that transmitters transmit and that navigation equipment tracks correctly. Check all instruments for normal operation.

Call radar and check transponder/encoder operation.

2. Flight controls should be smooth. The aircraft should trim up and fly hands off in smooth air. Rigging should not require a trim tab unless wings are warped (washin/washout) due to prior damage. Only Alons and Mooney Cadets were built with trim tabs. Ercoupes are trimmable by bending the trailing edge of ailerons (within certain limits).

3. All engine gauges should be in the green. Check cylinder head instrument, if installed. Readings in flight should be 400-475°F or less.

4. Oil temperature should not exceed 100° above ambient temperature. Excess temperature may indicate baffling that will need to be fixed or that there is excessive clearances on rods, mains and cam bearings. 220°F is the max allowable temp. Too high oil temp causes fretting of the engine halves. The aluminum case is malleable at 190° which is the optimum temperature and allows the case to expand properly -- high oil temp can cause case cracking.

5. Oil pressure should not drop below 30 psi when oil temperature is stabilized at the hot operating temperature. This is a biggie -- if the pressure is lower than 30 psi, it could be major overhaul time. Overhauls are expensive and crankshafts are getting scarce.

However, there may be a particle under the oil pressure relief valve causing lower pressure. This is easy to find -- just remove acorn nut R/H rear on engine, remove spring & plunger. Check for particle and reinstall. Usually find piece of plastic from oil bottles that fell into tank when adding oil.

6. Cylinder head temperature should not exceed 425° or so in cruising flight, 475 degrees on climb. Even these numbers may be high. John Wright, Sr., cited several planes on which he works, that have excellent engine baffles, which show 360° in cruise and 400°-410° in climb. Most Coupes, says John, show about 350°-375°F in cruise. The book says the limit is 525°F max, but you will cook your engine long before that.

MISCELLANEOUS

1. If tail height is too low (airplane on level ground), new main landing gear doughnuts may be required, perhaps spacers will also be needed to bring the height up to normal. Normal height of the vertical stabilizers is 75 inches. If the tail height is below 68 inches, the doughnuts should be replaced. This is a 2-3 hour job. A low tail will adversely affect crosswind landing behavior.

A low tail will also cause fuel pump failure in cold climates. Water will collect at rear of main tanks and not drain out of drains at front of tanks. After water is pumped to fuel pump it freezes at the pump diaphragm from cold ram air and breaks the pump actuator link. This is tough to troubleshoot and can be costly. Is double fork nose gear installed? Even good donuts may need 7/16" spacer to get 72-75 inches on tail when you have a double fork nose gear (which is 1.5" longer than a single fork gear).

2. Inspect fuselage skin for signs of wrinkling due to a hard landing or minor accident. Remem-ber that this skin is the load-bearing structure. Closely inspect belly skin below rear spar. It will be pushed downward and have a unique outline of the rear spar of the aircraft has been damaged on landing hard. Check rear spar for deformation if belly shows this problem. Repairing or replacing rear spar is very expensive ($2,000 - $3,000).

3. Have wing fabric tested with a non-destructive tester. Discuss with owner ahead of time who's responsible for repairs if the fabric tester punches through the fabric.

Use "knuckle" test on fabric if tester is unavailable. Hold hand in fist, rap middle knuckle on fabric rapid movement. Fabric will sound good, no dope cracks at point of rap, tight, drum-like sound from fabric with no depression at point of rap. Pay special attention to top of wings. According to Burt Ellegaard, there is no documented test for Ceconite.

4. Check equipment list, A.D. compliance record, weight and balance record, 337s on modifications, approved flight manual, ELT & battery, I.D. plate at rear of fuselage, dataplate on engine for proper horsepower stamping, lock books showing TTAF, SMOH, STOH, oil change entries, preventative maintenance entries, annual inspections, STCs or major repairs, yellow tags for any appliance repairs, encoder/altimeters test (required bi-annually for VFR flight).

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