

December, 2001

## Oil Filter & Vac Pump Installation In R172K

If you want to obtain better filtration of your engine oil system, then installing the full-flow filter instead of the oil screen is a good idea. When you went from the IO360K model engine to the IO360KB, Continental Motors type certificate data sheets indicate you received only a crankshaft modification, and both engines are eligible for the optional CMC Eq. No.6001 or EQ6522 oil filter adapter installations. Unfortunately, neither of these adapters are available through Teledyne Continental Motors (TCM) for either of the -K and -KB models. Cessna does sell the oil filter installations, as a TCM adapter kit p/n EQ6589, direct from the airframe parts manual, for a list price of approximately \$480. These prices are through any Cessna dealer, such as Yingling Aircraft of Wichita, KS at 800/854-2647. Stand-by vacuum system is a good idea if you doing any instrument flying. AeroSafe of Gransbury, TX <[www.aerosafe.net](http://www.aerosafe.net)> sells the GUARDIAN I, an electrically driven vacuum pump as a standby auxiliary pump to the existing instrument air system, at 800/433-5689 or 817/279-9666, for \$2000. Precise Flight Inc. of Bend, OR <[www.preciseflight.com](http://www.preciseflight.com)> or (800-547-2558) sells the SVS System, a stand-by vacuum system that operates off the engine intake system in the event of primary vacuum source failure, and sells for \$430.

- By Adam Halop

## Abrasion Boot Removal and Installation For 172

The 1232040-3 abrasion boot part number has been superseded to P/N 1232040-5, available from Cessna for approximately \$35/roll. Chapter 4 of your 1976 172M Skyhawk service manual gives removal and installation procedures for the abrasion boot of the horizontal stabilizer in paragraph 4-23 & 4-24, as follows:

### REMOVAL:

The abrasion boots can be removed by loosening one end of the boot and pulling it off the stabilizer with an even pressure.

Excess adhesive or rubber can be removed with Methyl-Ethyl-Ketone (MEK). Be careful with the MEK coming into contact with your paint for any length of time, because it may discolor or even remove the paint.

### INSTALLATION:

1. Trim boots to desired length. You may want to remove the forward root fairings and stabilizer tip fairings better access to the abrasion boot ends.
  2. Mask of boot area on leading edge of stabilizer with 1-inch masking tape, allowing 1/4-inch margin.
  3. Clean metal surfaces of stabilizer, where boot is to be installed with MEK. You'll find MEK works faster than alcohol, but can be risky to use. The smell alone...ARGH! Alcohol requires more elbow grease.
  4. Clean inside surface of abrasion boot with MEK.
  5. Stir cement thoroughly. (3M Product 1300L contact cement, obtainable from Aircraft Spruce and Speciality Co. <<http://www.aircraftspruce.com>> or phone 877/477-7823.
- NOTE: The contact cement can be thinned-out and applied easier with a brush in multiple layers (2 or 3 layers with sufficient drying time between each application), for a smoother finish. Toluol or MEK is suitable for thinning-out, and later reactivating the glue.
6. PER CESSNA: Apply one even brush coat to the metal and the inner surface of the boot. Allow cement to air-dry for a minimum of 30 minutes, and then apply a second coat to each surface. Allow at least 30 minutes (preferably one hour) for drying. (If the glue-out-of-can starts to "glob" and not spread evenly, try thinning out the glue).
  7. After the cement has thoroughly dried, reactivate the surface of the cement of the stabilizer and boot, using a clean, lint-free cloth, heavily moistened with toluol. Avoid excess rubbing which would remove the cement from the surface. Using a brush to apply the toluol will give you a little more control, but don't use so much toluol that it begins to run.

8. Position boot against leading edge, exercising care not to trap air between boot and stabilizer. Prior to reactivating the glue, position the boot in place. Note the installation needed to keep a straight line along the boot edge in reference to the masking tape. You may want to draw a line down the stabilizer leading edge and cement-side boot centerline, for alignment of the boot installation.

**CESSNA NOTE: Should boot be attached "off-course", pull it up immediately with a quick motion, and reposition properly, provided, the glue is still wet and in place.**

9. Press or roll entire surface of boot to assure positive contact between the two surfaces. Start at one end, align the centerline on the stabilizer leading edge and boot, reactivate a portion of cement (about 6 to 8 inches at a time), and roll the boot along the centerline marks & outward toward the boot edges. De-ice boot manufacturers sell a special roller, with a nifty handle. A rolling pin will work fine, or the handle of a hammer will do. The idea here is to spread the boot out and avoid trapping any air

bubbles. Be careful not to “push” the boot surface when rolling out the boot, to avoid stretching the boot and deforming the finished installation. Over time the boot will lose its strength and peel at the ends. Also, a stretched boot won’t keep a straight line. If you do get bubbles in the surface, while maintaining an “on-course” installation with straight boot edges, then prick the bubble with a pin and attempt to push the air out the pinhole. This may take more than one pinhole, but be gentle.

10. Remove masking tape and clean stabilizer of excess material. As you can see, this is not a slam-dunk process. Total removal and installation time can vary for the amount of labor it takes to clean the old glue away from the stabilizer leading edge surface. Estimate about 2 to 3 hours for each stabilizer leading edge.

If you only need to repair or reattach a few edges, then clean away as much old sealant as possible, insuring a smooth, flat mating surface. Apply cement, as mentioned above, to the boot area and stabilizer surfaces to be reattached. Dry, reactivate, press and roll. BF Goodrich manufactures a conductive edge sealant cement to apply to the boot edges after you have reattached the boot to the stabilizer. Edge sealant and rubber protective agent can be purchased from Aircraft Spruce & Speciality Co., page 307 in my catalog. Check out page 296 for the Jet Stream Pbs boot sealant treatment, as well.

- By Adam Halop

## Qualifying 414s and 421s For “Known Icing”

Both Cessna 414 and 421 did come from the factory with the option of “flight in known icing” in 1975, starting with 414-0601 and 4210801 respectively. Cessna would plumb these aircraft between the fuselage and wings, and empennage and tail at the factory, but if “known icing” was not desired then other related components (valves, electrical switches and boots, etc.) were not installed. Cessna sells an accessory kit to install the necessary components to finish the option for “flight in icing conditions” with AK421-106. These kits are made to order from Cessna and at the last estimate was priced about \$12,000-\$15,000 per wing/tail plus the pilot’s windshield, hot props, etc. You may obtain the accessory kit documentation from Cessna at 316/517-5800.

- By Adam Halop

January, 2002

## 182 Firewall Reinforcement

Is there a Cessna bulletin/letter that pertains to firewall reinforcement, particularly 182B s/n 52082? Cessna Service Letter SE63-10 #2, “Firewall doubler - Model 182” for aircraft prior to mid 1963, s/n 18254610 should be what you’re looking for.

- By Adam Halop

## 310G Cylinder Head Temp

**Q.** I returned to Southern CA, this past Sunday from a trip to Napa, CA, and about an hour into the 2-hour flight, I noticed that the right engine cylinder temperature had almost fallen off the gauge. I checked the single probe EGT on that engine and it showed a lower temp than the left engine of about 300 degrees (1140° vs. 1440°). The oil temp and pressure on the right engine was still in the green but slightly low as compared to the right. The aircraft is just back from annual inspection and we replaced one cylinder on the right engine so I was running at high RPM (2450) and full throttle. I was cruising at 13,000 feet and the OAT was -7° C. I believe the EGT probe and cylinder temp probe are on the same cylinder so maybe it was just that one or maybe? Everything returned to normal on descent to warmer air and in the landing pattern.

**A.** The technician who installed the “new” cylinder most likely informed you of a “break-in” procedure for the initial hours to seat the piston rings against the cylinder walls. You want to start the trouble shooting process in “easy-to-get and least expensive” steps. Verify that your cowling and baffle seals are installed properly and in good condition

Check your single-probe EGT, and CHT probe, for security and condition as well. Inspect that no hot exhaust gases may be cooking the harnesses of the EGT and/or CHT systems. With all systems looking normal in and around the engine nacelle area, verify that the CHT probes are installed in the same cylinders of both engines. Next, get into the cabin and check the connections on the EGT and CHT harness at the respective indicator. Try swapping the left and right harnesses at the individual indicators to verify the problem and/or isolate the source of the condition.

- By Adam Halop

## Help in locating electroluminescent 421C Panels

*The panels you are inquiring about are as follows: Forward switch console panel p/n 9910122-2; Forward circuit breaker console panel p/n 9910122-6; Center circuit breaker panel p/n 9910121-14; Emergency power panel p/n 9910123-5. If want to purchase these parts, Cessna has available the -2 and -6 and they are very pricey. A salvage yard maybe a place to find all the panels you desire. AIR CAPITOL DIAL of Wichita, KS <[www.aircapitoldial.com](http://www.aircapitoldial.com)> at 316/264-2483 repairs electroluminescent panels. Before removing and replacing panels, your mechanic should check to see that there is AC current at the panel when the lights are on. I generally see more inverter failures than panel failures. A panel generally fails only when it gets shorted out.*

- By Adam Halop,

## Horizontal Stab Protection

**Q.** Wondering if you know of a legal rubber protection, abrasion boot or something to protect the leading edges from small rocks etc., on a 210E that is being flown off a gravel strip. Vinyl tape comes loose in the warm sun and in extreme cold. The local SDO has heartburn as one edge can lift and then it acts as a spoiler.

**A.** 3M INDUSTRIAL TAPE of St. Paul, MN @ 800/362-3550 sells a 8672 polyprotective tape for leading edges, and P.M. RESEARCH of Wellsville, NY @ 716/593-3169 has polyurethane tape for leading edges. These are alternatives to a rubber boot, which is still the best protection installation for your horizontal stabilizer leading edge.

Cessna no longer has available the accessory kit AK182-217G — Stabilizer Abrasion Boot Installation. You can still purchase the two 1232040-5 abrasion boots separately from Cessna for approximately \$35 each.

You can obtain the EC1300L cement, needed to attach the boot to the stabilizer leading edge, from AIRCRAFT SPRUCE AND SPECIALTY CO. [www.aircraftspruce.com](http://www.aircraftspruce.com) or 877/ 477-7823. Installation instructions for the abrasion boots can be found in a 1977 210 service manual, starting with paragraph 4-18 Chapter Four, or later year manual. An equivalent MIL-C- 21067 edge sealer is sold by B.F. Goodrich as De-icer Cement, distributed by Aircraft Spruce, on page 307 of the Spruce catalog, as p/n 09- 42535. The AK182-217G kit is

*applicable for all 210 aircraft and the instructions provided above parallel the kit instructions.*

- By Adam Halop

## Rudder Rigging For 182

**Q.** I talked to you the other day about the rudder rigging and alignment on my 1978 182RG. I need some more advice. During my flight check with the rudder fared with the vert. stab. It would yaw to the left hard before rolling. I then trimmed for this and did some power off stalls in which it handled them pretty straight except for a slight favor towards the left wing. I also noticed how far the bottom edge of the rudder is off from the tail cone when the top of the rudder is fared with the vert. stab. Is this intentionally designed for P-Factor?

**A.** Let us review the setting of the rudder/ rudder trim/nose landing gear steering for neutral. Remember, we're splitting hairs here to find any reason why the aircraft is not performing to specification.

Set the rudder trim to a neutral position according to the indicator needle. Using a hand held tow bar, swing the nose wheel from one stop to the other. Note the responsiveness of the nose wheel steering and the rudder operation relationship. Make sure the nose landing gear is at the proper extension when on the ground. I find this check is easier done while moving the aircraft into the hangar, steering right and left as I position the plane. I'll then park the aircraft with the nose wheel and rudder aligned with the centerline of the aircraft fuselage, while looking done the prop spinner, fuselage top structure, vertical stab, and rudder as reference. With this "coarse" relationship centering for neutral, I will later go into the cabin and fine tune the neutral position inspection. The nose gear should be at normal extension, not engaging the squat switch, thus centering the upper torque link and the strut collar. We want the nose steering to not preload the rudder check about to be inspected.

Next, go into the cabin and note the position of the pedals. The pedals should be close to neutral. If not, the rudder trim indication may be out of rig or a preload from the nose steering may exist. Operate the rudder pedals, pushing the left full forward by hand. Listen for the stops to engage at the control surface. Note the rudder pedal return position. Do the same for the right rudder pedal. The pedals should return to the same neutral position (within a half of an inch) each time. If the returned neutral position check shows a gross difference, then a preload may be occurring or the rudder trim/nose steering bungee is worn, (a spongy bungee can be a whole other inspection in itself). A preload from

rudder control cable tensions, rudder trim indication out or rig, or nose landing gear steering will have an influence on the operation and relationship of the these three systems to one another.

Now, operate the rudder trim wheel to a full right hand deflection. Push the left rudder in & release, and note the pedal position before and after actuating the rudder pedal. Push the right rudder in as well. With the rudder trim bungee at full strength & functioning properly, the pedals should return to the original position when the rudder trim wheel was rotated to the full right deflection. Perform this same check for the left rudder trim wheel operation. This inspection to establish the neutral position and check the rudder trim operation will assist you to determine the quality of bungee operation, rudder trim travel, rudder control cable tension and any preload on the three systems. You may find that the rudder pedals and control surface are both at neutral and the rudder trim needle is WAY off. The indicator needle will be the last to be corrected.

Once neutral has been established, inspect the rudder control surface for alignment with the vertical stabilizer. Centered to 5/16" to the pilot's left (looking forward from the tail) is the neutral position "window" for the rudder with the vertical stabilizer. When the horn of the rudder is towards the pilot's left at the top of the vertical, then the trailing edge lower tip of the rudder is swung to the right. This 1 degree or 5/16" of an inch is to compensate for the P-factor produced by the engine torque. Now, check the cable tension to be 30 lbs +/- 10. Follow procedures in the service manual to rig cable tensions, I'll mention this technique later in this letter.

The reason I mention the relationship of the vertical stabilizer and the top of the rudder control surface is to eliminate any discrepancy with the tail cone installation. If the holes of the tail cone are elongated, or the tail cone fairing is installed off-centered, the misalignment of the fairing can act as a rudder itself. Again, we're splitting hairs here.

The last item to check in this particular system is the rudder trim needle. This needle is very susceptible to "jumping" the groove. Once the rudder/rudder trim/nose landing gear steering systems have been rigged for neutral, the needle is then moved to the center of the actuator wheel travel. If the needle still doesn't line-up with the line on your pedestal cover, I recheck the entire rigging of the rudder trim system and then find 90% of the time that the needle has been bent due to this cover being taken off and put on, or a large meat hook hand has brushed up against the needle one too many times.

There is one more item to verify for accuracy that relates how the rudder & rudder trim will function properly to give you straight and level flight. You'll need to laterally level the aircraft. First, check

the lateral level of the aircraft across the upper door sills as the aircraft service manual states. Now, check to see if the level indicates the same across the seat tracks, (a digital level is great for this). If so, your hands are free to service a main landing gear tires with air, or deflate accordingly, to level the aircraft, (the digital SMARTLEVEL is great for this, with the audio beep to indicate level). Once you've got the "bubble centered" on your level and the plane is laterally level, check the turn coordinator ball to be centered as well, and adjust ball accordingly, not the little airplane on the TC face, the ball.

If all the above items check out fine and the aircraft still wants to track (not roll) to the left during flight check, with the T & B ball centered, or you find yourself using an extreme amount of rudder trim to keep level flight and a straight heading, then you might try to exchange the large amount of induced rudder trim actuation with some primary rudder control surface compensation. Using a give-and-take method of cable turnbuckles tension adjustment, you can swing the rudder control surface over to the left while keeping your neutral position.

To do this, set the rudder/rudder trim/nose landing gear steering to the proverbial neutral position. Clamp a 2X4 across the pilot's rudder pedals. Now, cut safety wire at the rudder control cable turnbuckles under the vertical stabilizer.

Using a bent coat hanger between the two cable terminals, holding the terminals stationary, rotate the right rudder turnbuckle, loosening the cable tension approximately 10 lbs. Tighten the left turnbuckle 10 lbs. Safety turnbuckle accordingly. You've kept the required 30 lbs +/- 10 tension on the control cables, and moved the control surface to compensate for some reason the aircraft can't seem to fly straight and hold a heading. Fly the aircraft. Did the symptoms get worst? Are you flying straight but have lost some speed in doing so?

We've only discussed a few of the components and systems that make up the entire flight control operation. Remember to keep in mind that the sequence of rigging and flight test is essential to rigging the aircraft flight control systems and the key to speed. Always refer to the Cessna R182 service manual for proper details when disassembling and assembling the aircraft components and systems.

- By Adam Halop

## 172N Flap Rigging

**Q.** A question regarding rigging on a C172N. I have read the service manual and your technical article. I have leveled the aircraft by shimming wheel to get a level reading when measuring across seat tracks.

Next, with a smart level I measure the angle of the under side of flaps. Left 4° and right 6° when fully retracted.

You suggest attempting to measure the angle of the drive and driven pulley-bellcranks, but I haven't found an easy way to get very precise measurements (bolt in bellcrank to rear spar). Push-pull (actuating) rod lengths are at proper specifications given in service manual. What would you suggest to get the flaps at the same reading. The service manual doesn't address this issue. Manual says to rig with flaps forced fully up by hand. (Adjust pushpull rods so bolt hole lines up—rod end and pulley—bellcrank). If both flaps are forced fully up by hand so rollers reach end of track and flaps angles are incorrect, then it seems the tracks are worn or wing is out of true? Because the ailerons are adjusted to the flaps, you know why it is necessary to get the flaps equal.

**A.** *First things first. To level your 1977 172N Skyhawk, your service manual states in paragraph 2-5 of Chapter Two, "Corresponding points on the upper door sills may be used to level the aircraft laterally. The reference points for longitudinally leveling the aircraft are the two screws located on the left side of the tailcone (actually the fuselage). See figure 2-2 for screw location (Sheet 1 of 2)." If the seat tracks have never been replaced and the fuselage structure has never been damaged (twisted), a level across the seat rails, with no carpet interference, should read the same as across the upper door sills. I use the upper door sill reference to set the aircraft laterally level with my level set on a balance bar similar to that show in figure 18-2 of Chapter Eighteen, "Checking Wing Twist".*

*Servicing all the landing gear tires to the proper pressure, checking the aircraft lateral level, then releasing air from the "high side" tire should suffice if the hangar floor is not level. Setting the aircraft laterally level is usually performed to check if the turn coordinator ball is centered. A complete leveling of the aircraft for flight control rigging would be performed when checking the aircraft symmetry.*

*You stated that the flaps had a 2 degrees differential when the flap panels were retracted. The SMARTLEVEL check at the lower flap panel is to check the flap deflections relative to each other, and to use the SMARTLEVEL "alternate zero" function as a starting point. Before going any further, you might want to check the location of the aft wing attach bolts/wing cams, seen in figure 4-1 (Sheet 1 of 2) of your service manual, Chapter Four) Note that if one wing is set down and the other wing set up, there will be a difference in wing angle of incidence between the two wings.*

*You mentioned, "... seems the tracks are worn or wing is out of true?" Figure 18-2 will give you the information needed to check the wing twist and using the symmetry check information in Tech Note# 014, you'll be able to verify if the wing is true. Cessna*

*supplies new flaps tracks with an opening dimension of 0.5635" and allowable wear limits set to 0.6035". Meaning, if you can place a 5/8" bolt or drill bit (machined down to 0.6035") through your flap track opening, that track is worn beyond limits. Cessna service bulletin SEB95-3 has information about flap roller kits and washer installations to slow down this flap track wear. McFarlane Aviation, Inc. <www.mcfarlane-aviation.com> @ 800/544-8594 or 785/594-3922, and Bueco, Inc. <www.bueco.com> @ 800/325-6163 or 636/947-0212 also sells the flap roller kits.*

*To perform an angularity check of the actuator bellcranks, I use a straight clothes hangar, with a 90 degree bend of about 1/2 inch at one end, to measure the distance from the push-pull rod arm bolt hole on the bellcrank to the wing rear spar. While holding the clothes hangar 90 degree bend against the rear wing spar, and using the pushpull rod as a guide, I follow the clothes hangar with my finger and mark the bolt center on the clothes hangar with my finger. If the distances are not the same, the correct position can be obtained by a give-and-take adjustments of the flap extend and retract control cable tensions*

*- By Adam Halop*

**June, 2002**

## **177 Cardinal**

### **Cardinal vs. Skylane**

**Q.** *Is there a possibility of talking to you about the purchase of a Cessna. I have never owned an airplane before and am having a great deal of difficulty making a decision on the type of airplane. Either a 177 or 182. I would like to get your opinion on the pros and cons of each, and then how do I proceed with the purchase once I have decided. Also how do I decide if that's the one?*

**A.** *Cardinal versus Skylane? Both are good aircraft and yes, both do have items of concern when dealing with maintenance and upkeep.*

*The Cardinal has the Stabilator attach and the cabin door hinges to keep close attention during annual inspection and pre-flight.*

*The Skylane has no huge outliner of maintenance problems. I would be cheating you if I did not recommend John Frank's 182 Buyers Guide at this point.*

*The following is performance characteristics from 1977 year aircraft:*

- Both aircraft operate a carburetor style fueled engine. The Skylane has an O-470 Continental engine with 230 Hp with a TBO of 1500 hours unless you have the necessary upgrades to extend the TBO to 2000 hours. The Cardinal has a 180 Hp. engine with an 2000 hour TBO. Both aircraft have*

constant speed props.

• The Skylane can operate at 450 lbs more ramp weight & 160 lbs more useful load than the Cardinal. Rate of climb is faster with the Skylane. At 6000 feet, 65% power @ 2100 rpm the Skylane is 16 knots faster while burning 2.6 gal/hr more fuel. The Skylane holds more fuel, but both aircraft are somewhat equal in range, within 50 Nm and 20 minutes from the same altitude. The center of gravity envelope is 2 inches larger for the Skylane. Even more if the Cardinal is Utility category. Best glide within 5 kias is basically the same nautical miles.

The Cardinal has integral fuel tanks, while the Skylane didn't go to integral fuel bays until 1979. The Skylane uses fuel bladders up to 1978. One item of interest to note would be the production of each aircraft: approximately 2752 Cardinals produced from 1968 through 1978, and approximately 35615 Skylanes produced from 1956 through 1986. And, of course, the new Skylanes are still being pushed off the assembly line to this day. You'll find more parts support with the 182 and the later model 177.

- By Adam Halop

## Cardinal RG Wing Question

**Q.** Is the information that I have correct, that the Cardinal RG's year 1973 through 1978 had the exact same wing? If this is the case does that mean that all could be considered as replacements for any 1973 through 1978 aircraft? Also, where on or in the wing can you locate a part number or "N" number that could be used for verification?

**A.** The complete wing assembly has differences throughout the 8 years of Cardinal RG production with the differences in part numbers found in the illustrated part manual.

Differences between the 1973 (serial number 177RG0283 - 0432) and the 1978 (177RG1267 - 1366) Cardinals are as follows:

- L & R wing structure assembly,
- Wing root rib assembly @ W.S. 26.00, brackets and cable supports,
- Outboard, lower wing access panel doubler assembly,
- Wing leading edge assembly and stringers,
- Fuel filler cap and cap door assembly,
- Fuel transmitters,
- Fuel drain plug and packing,
- Flap lever arm support assembly.

The wing angle-of-incidence is the same for all 177RGs @ +3.40 washout from root to tip, and wing span is the same @ 35'-6". Along the inboard wing rib, @ W.S. 25.25, between the fuselage and wing,

you should find the identification assembly plate for the wing, towards the leading edge of the wing. Look for the wing structure assembly part number, 2022001-X.

## 177 Abrasion Boot

**Q.** I'm looking for the abrasion boot kit documentation. Can you point me to it on the web or send it to me?

**A.** The AK182-217J kit is longer available, but the parts are. 1232040-5 is the part number you need to install one boot with 3M contact cement p/n 1300L, which can be obtained from Aircraft Spruce And Specialty Co. <[www.aircraftspruce.com](http://www.aircraftspruce.com)> phone 877/477-7823. The boot is sold as an option for your aircraft under p/n S1938-3-68.00 as a bulk item, and cost approximately \$61.00 to do both boots. Go figure why the kit part number is less expensive?

- By Adam Halop

## 177RG Circuit Breaker

**Q.** I have a '75 Cardinal RG and I am trying to determine if I have the old white, or new black, 60 amp alternator circuit breaker described in what I'm told is Cessna Service Bulletin SE 76-15.

**A.** Cessna has service bulletin SE76-15 Spares Replacements of S1596-60L Circuit Breakers and the noted service kit SK150-46 cover sheet to assist with the identification and replacement of early model circuit breakers.

- By Adam Halop

October, 2003

## Control Column Service On Slide Style Yokes

**Q.** I have a 1979 T210N with avionics upgrades in our shop now. I would be interested in the inspection procedures done during any major avionics upgrades.

**A.** The figures below are an illustration of the 210 control column from your Centurion service manual, which I will make reference to for recommended "inspection procedures done during any major avionics upgrades".



**Control wheel tube and roller bearings.**



**Control wheel assembly on the control tube assembly.**



**Forward end of the control yoke assembly and the box bearings installed over the control tube assembly at the aileron drum.**



**The result of too much force, improper directional load and, of course, LACK OF LUBRICATION!**

First, I'll start with some "just-to-know" information of how the control column system works, and then move into why we need to lubricate and replace items if needed:

- The control wheel tube (item No.14) rides through the instrument panel on a set of three eccentric bearing assemblies (6) over the stationary control tube assembly (20). The control wheel tube has a set of four roller bearings (15) connected to it at

the extreme forward end of the tube. It is this forward bearing assembly that rides over the square cross-sectional control tube assembly (item No. 20 in View A-A). This set of bearings I call the "box bearings" of the rotational column. The box bearings can affect the rotational movement of the control wheel when you actuate the ailerons, even though their primary function is to guide the control wheel tube over the control tube assembly for elevator control.

- The control tube assembly is further supported by set of bearings (8, 9 & 10) that run over the outside diameter of the control wheel tube (14) just aft of the box bearings, and are held up by a push-pull tube assembly (22). This set of bearings I call the collet assembly, which slides over the control wheel tube while being supported by the push-pull tube assembly. The collet bearing assembly is made up of one bearing assembly, two bearing races, one thrust bearing, a sleeve weld assembly, retainer, washer and snap ring. The collet bearing can affect the vertical & horizontal movement of the control column while it sits in the instrument panel.

**Now for the replacement items during major avionics upgrade:**

- When the instrument panel is completely disassembled and/or removed from the aircraft, access to the control column assembly is much easier. This is the time to replace all the worn bearing assemblies. If the bearings have been allowed to wear into the control wheel tube and/or control tube assembly, then this too would be the opportune time to replace these items as well. Current prices? Let's see — S2010-3 bearings (item#6) \$106 each and there are three/control wheels. The 1260140-13 control wheel tube (with new bearings) sold as an assembly goes for \$2890.

Good thing too, the box bearings by themselves are \$53 each and if you need to replace one, you really should replace all four. The collet bearings are \$23/set if you don't have to replace the retainers and sleeve weld assembly. Then, the last thing to replace (if worn) is the control tube assembly for \$835. Total parts for just the bearings for one control column will be just shy of \$400, and if the control tube and/or wheel assembly are worn, then we're talking big bucks. Actually, these parts are rarely replaced and can go a lifetime with just a little preventative maintenance.

The eccentric bearing assemblies have the most potential to wear first, but these too can have their service life extended with a little lubrication: Here's what I'd recommend:

- During annual inspection (or in your case, major instrument panel work) lubricate the box bearings with some LPS-3. If these bearings are loose, then tightening the four 0760644-1 machine screws (42) will remove any side play in each roller bearing. Make sure the rollers are free to move, but the lubricate is the key. During annual inspection, these

bearings can be seen with the front seats removed and rotating the control yoke accordingly. LPS-3 with a couple of the (supplied) red nozzles heat-shrunked together will allow you to apply the lubricant directly to the bearings area. Be sure to operate the control wheel tube assembly fore & aft in the elevator control direction so to work the lubricant into the needle bearings of each roller and onto the control tube assembly (20). The LPS-3 applied onto the box bearing will distribute itself onto the square shaft.”

The LPS-3 works as a Rust Inhibitor on all of these steel parts and creates a wax layer for the rollers to glide over the control tube assembly.

Now for those pricey eccentrics! The eccentric bearing assembly (item# 6) is made up of three rollers that have an off-set mounting stud set 120 degrees apart around the control wheel tube. These bearings are eccentric because you can adjust the amount of friction of fore & aft movement on the yoke, as well as the amount of play in the panel opening. (I'll get back to that friction.) Each roller bearing has an impregnated neoprene shell over its circumference so to protect against metal-to-metal contact on the control wheel tube. You'll want to carefully apply some LPS-1 into the rollers of this bearing. Now, undesired friction can be created when you actuate the control yoke for aileron operation against the neoprene shell of the bearings. This aileron movement works perpendicular to the roller bearing movement and creates unwanted friction. The “shell” gets hot and cracks, breaking off and you have metal-to-metal contact. It is this metal-to-metal contact that can wear into the \$2890 control wheel tube.

Here's how to reduce the heat on the neoprene shell. Pull out the control yoke and apply a light coat of silicone spray to the tube shaft. You'll also want to adjust the eccentric bearing friction against the control tube to “just snug” as little movement as you can handle at the instrument panel opening and not create that undesired heat.

– As for the collet bearing? This job is realistically done during complete instrument panel removal; when the yokes and instrument panel are completely removed from the aircraft. No preventative maintenance, except lubrication. But access during annual inspection is limited.

So, to review. Preventative maintenance here can save you mucho \$\$\$. The occasional adjusting of bearings will enhance the flight control column responsiveness and lubrication will give you the much desired longevity.

Other items to replace, service and look at during complete instrument panel removal/rebuild:

- All rubber hoses. Cessna Service Bulletin SE82-8 gives guidelines for Vacuum System Maintenance and recommends the replacement of all rubber hoses every 10 years.

- Ventilation ducting. Get rid of the original Cessna black ducting and install new Scat silicone ducting.
- Lubricate all cabin ventilation controls. With these control cables entirely accessible, be sure to lubricate them well with LPS-1 or the equivalent.
- If you have to remove the side-kick panels, you'll need to take a good look at the factory soundproofing, (those vinyl panels glued to the cabin interior skin walls). The glue is very conductive to water and attracts corrosion. If you can pull these panels off, you need to remove the corrosion and treat the bare metal. At this time, it would behoove you to consider a different soundproofing material for your aircraft.
- Engine controls. Cessna recommends in their inspection guide of Chapter Two to replace these components every 1500 hours.
- Anything that you'd have limited access to.

- By Adam Halop

## LPS-3

**Q.** Do you really mean LPS-3 for the control yoke bearings? LPS-3 dries to a hard waxy consistency. I thought it was used mainly as a coating for corrosion prevention. I have used it that way for decades on motorcycles and boats. Is this the same procedure to maintain the control column on a '68 182?

**A.** The reason I like LPS-3 on the box bearings is to create the wax barrier for the rollers to glide upon the control tube assembly. Not only does this lubricant work the rollers, but it lubricates the control tube assembly. In a closed environment, such as behind the instrument panel, the thicker based LPS will not be introduced to too much debris. You are correct, this procedure will work for the 1963 and on Skylanes.

- By Adam Halop