The O-200 Engine Swap

This writeup was created to fill in some of the missing links for an owner to change the C-85/C-90 engines in a 120/140/140A to an O-200. It is intended that this article will allow a more orderly procurement of parts and permit a better assessment of the tasks ahead. This September '05 update is for the purpose of changing the "Emmett" STC ownership to that of Thompson's Air.

Mount

The O-200 requires the mount which was first used on the C-90-14 equipped 140A's which had the engine with the Lord mount feature. Note that those 140A planes with the C-90F-14 engines already have the correct mount. Often confused with the "Dynafocal" mounting, the Lord mounts give better vibration isolation than the non-Lord mounts used with most C engines, but not as good as Dynafocal would. In Spruce, the mount is listed at about $900 in 2005.

Engine

The STC states only the A engine can be used. The Rolls Royce-manufactured version of the O-200 is not mentioned, so check that with your FSDO as to acceptability if the opportunity to buy one appears. (The B is for a pusher only, and the C has a hollow crankshaft for variable pitch prop control.)

Information sources

Something so simple, so important and so easy to get....information. You are going to spend a lot of money to make this conversion and you and your mechanic will require specific information available only in one or several of these books. Recommended for this conversion and for the future care and feeding of the plane and engine would be the Cessna 120/140 (or 140A) Parts Manual, the Continental C/O-200 Engine Parts Manual and the C/O-200 Overhaul manual. Since it is most likely that your O-200 will come from a Cessna 150, the C-150 Flight Manual with its engine charts and operating procedures will be helpful to you as well. All are available through Aircraft Spruce, Univair, etc.. The Reference Manual by the International 120-140 club is also useful, valuable, and grows more valuable when you add special articles to it.

All of the above except for the International Reference Manual are available on CD's from McCurtain Tech Group at http://www.mccurtaintg.com/ . For example, the CD for the planes includes the parts manual for the 120/140's, the parts manual for the 140A (better figures) and the Operating Manual for the 120/140's. The tremendous advantage is that the files are .PDF type and so details can be expanded by up to 800 percent and then printed. ($20 for the Cessna manual CD and $20 for the engine manual CD.)

The engine detail in the plane parts manuals is poor, whereas the engine pictures in the Continental overhaul manual and parts manual are superb. Sometimes, that small detail you can see in one and can't see in the others makes the purchase price worthwhile all by itself.

The Aircraft Spruce catalog, free, is great help; the information in the catalog about how to do things and what matches what is invaluable. If you study the manuals and determine what extra parts are required and prepurchase them, you prevent delays and save money as well. It will soon become plain that I refer to it a lot because being able to see the combinations noted makes comprehending them so much easier.

Accessories

It is important to try to get a complete engine, with the accessories, and one of the reasons is that each shaft-driven accessory that comes with the engine will also come with its gear. In the event you bought the engine without the accessories, then you have to buy not only the accessory (with an individual airworthiness yellow tag) but the gear used with it. Some examples: the new gears for the mags are $200 each and the gear for the vacuum pump is $200 and the adapter for the pump is another $200 to add to the price of the vacuum pump.

Get the written promise that all is well with the engine and that it will produce proper oil pressure. That last one is expensive if you end up not getting proper oil pressure. As an example of what it takes to correct low pressure if the pump is at fault; about $800 to have the accessory case overhauled added to new gears and plate for the pump.

The point: buy the engine complete if at all possible. To not do so is to create lots more work, lots more delay, and lots more cost than would be apparent to get a bargain with poor or no accessories.

The generator on your C could be used on the O-200, the magnetos may be usable...compare part numbers, and the starter on the C engines is definitely usable. Only a very few of the C engines have the vacuum pump but it would be usable on the O-200 if you have it. The carburetor on the C engines cannot be used on the O-200 (they would work, but would not be approved). If you were to get a bargain O-200 but without the Marvel carburetor, your bargain would cost about $900 more just for a new rebuilt Marvel.

Take it Off

As you wend your way through this writeup, you will soon conclude that we advocate taking off all the accessories and carefully inspecting them. We have found too many sins or errors covered with the statement: "it was just overhauled". Sometimes, the accessories are wrong or long past their overhaul threshold; older Slick mags, age-dependent, are supposed to be discarded after 500 hours of use. My engine, sold by an Oklahoma FBO as being up to par and claimed by the users to be the best on the line, was found to have a carburetor which had two stutter points on takeoff and a serious stutter when applying power in the air...and turned out to be not even overhaulable. The alternator looked so sick before removal that an overhaul seemed necessary for it. After removal we found that its fan was loose to the shaft and excess play end to end. Surprise, it was not even good as a core because it was from a car, not manufactured for an airplane!! This, from an FBO in the shadow of the FAA hometown. The cost to you of this inspection step will be for the replacement gaskets.

Cylinders

There is a service bulletin against Continental cylinders built between 1/1/96 and 5/15/98. The preferred cylinders are those which incorporate the new valves for 100LL, and those from manufacturers which allow 28^{o} BTDC ignition rather than the mandated de-rated 24/26 setting of the old cylinders. See the July 1995 issue of Light Plane Maintenance for the best article on the O-200; it mentions the correct part numbers and features of the new valves and advises that at least one of the official Continental lists has the numbers backwards. Cylinders are not just cylinders. Make sure you know what you get. Millenium brand cylinders are believed best, ECI next, and new Continental cylinders also allow the important 28^{o} BTDC setting.

Propeller

The STC lists the recommended props but mentions no options for twist/pitch. There are several other props which can be used with O-200's on other airplanes but only those on the STC can be used for the 120/140's, so be careful what prop you buy....you may not be able to use it. You cannot use the prop off of the C engines. There are many discussions about "climb" or "cruise" or "in-between" prop advantages and disadvantages. See the 120/140 web site section for some opinions and start thinking about which you want. Sometimes, one pitch can be made into another, but not always, and nobody knows until the prop overhauler has made an assessment. From stories in the web site and experience here, the cost to have a prop overhauled and perhaps retwisted ranges from $150. When you buy, make it a condition of purchase that it must meet the criteria you have selected.

Propeller descriptors mean something: typical for matching to the O-200 are those whose part number includes something like: 6950. The 69 is 69 inches in diameter and the 50 is the pitch. Pitch, if air were jello and there was no slippage or drag, means that the propeller would advance 50 inches for every revolution. The pitch of xx46 allows the engine to turn faster and so the climb is faster, whereas 52 means a slower climb but a higher cruise speed.

The prop I purchased was a "46 climb prop", but I wanted the 52 pitch recommended in the STC, and so paid the seller FBO to have it changed to the desired 52. When the engine had been installed and then run at maximum static runup to see if it was in limits, it exceeded it slightly (50 RPM's or so) so I had to take the prop to a prop overhauler 80 miles east. There, it was found that the Oklahoma engine seller and the Oklahoma propeller shop had decided I would not mind if it was only a "near-50"....and they did not include me in the decision. I had to have it altered to meet the static maximum and so had it redone....it is now a 51 pitch because the locals decided that was the most they could alter it....I do not know the "why" but it has proved to work well. After, I was glad I had it done because the Oklahoma prop guys apparently did not

match the two sides so that they were the same. A yellow tag from an incompetent shop has the same value as one from an excellent shop.

Prop bolts, if you don't get them with, can cost up to $120 for a set! Get them "with" if possible. As you read this, you will gain an appreciation for the importance of getting the "little stuff" "with". The little stuff can be expensive and very hard to find.

There are now three props which can be used to satisfy the STC. The limits are those of the static runup which the combination must meet. In the emails of the web site, owners list that they found their props ranged from a pitch of 57 (wow! He found out why it took so long on takeoff.) to 44 (and this pitch drastically exceeds the static RPM's and exceeds the engine maximum when in maximum cruise setting but is allowed for float planes).

In all my reading and researching about propellers, I found no useful information on which to choose to be used with the O-200, but old-timers tales abound. The Thompson's Air STC allows a much wider window of RPM"s for each of the props.

My plane, with an O-200 with 200 hours SMOH, a questionable carburetor, and a prop which had been slightly mis-twisted to a "near-50", exceeded the static runup on a 60° day, 400 feet above sea level. Note that the static numbers, taken as gospel but without parameters, do not specify air density or temperature so the same prop which would not pass the test at a high altitude airport would pass at sea level.

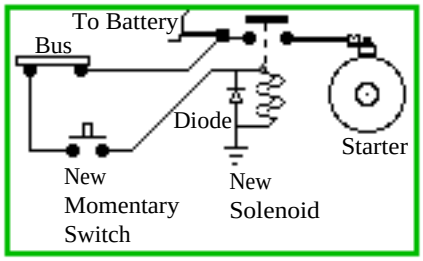
If there is a place where a "standard" O-200 has been statically tested at the 44, 46, 48, 50, 51, and 52 pitches which are used by our members, I have yet to find it. And wouldn't it be nice to be able to have such a table to there see the actual differences in not only RPM's but climb rates?

Prop spinner

Most of the 120/140's have the small prop spinner but most O-200's will come off of 150's and they have a quite different spinner. You can stay with the small spinner, the easiest accommodation, or you can determine if you want to use the 150 spinner. Make this a question at the first meeting with the mech and FSDO because some 150 spinners will require sanctioning. Everything comes with a price and the cost of the "pretty" 150 spinner is that the bigger spinners are mounted on a backing plate and that plate gets in your way every time you want to remove or re-install the cowl for maintenance, inspection, or cleaning. Some mean you have to remove the propeller and the backing plate to get the cowl off.

Starter, Electrically Controlled

Sometimes, the O-200 comes with the electric starter, as mine did. Many shy away from that type but I have been delighted with it. If you use it then necessary additions include a starter solenoid (because no switch you would want to carry has the ampacity), wiring changes, and a momentary starter switch. In an attempt to make sure the switch is never re-activated when the engine is running, I used a high capacity DC momentary toggle switch with one of the military aircraft safety covers over it. Some elect to change the existing ignition switches to be the keyed type with a "start" position as well. Use a new one or ensure that a secondhand switch complies with the regulations...one brand has an AD against the older ones.

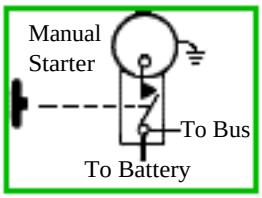


Don't forget to include the diode across the coil to kill the kickback (almost 400 volts) when the solenoid releases. With the electric starter, the battery cable needs to be rerouted to the input terminal of the new solenoid and from there to the bus in the cockpit and from the output terminal of the solenoid to the electric starter. That combination limits the position of the solenoid installation to a portion of the firewall so do some planning to make sure the cables will reach. See the sketch for the electrical hookup.

And recalibrate the compass after the job is "done"; it will be affected by the changes, sometimes significantly.

Starter, Manual

Manual starters on the O-200 are the same as on the C engine. No changes necessary unless your pull-start cable is not long enough because the new mount moves the engine forward.



Master Switch

This mention is between mags and the starter paragraphs because there may be a decision to be made here as well. Some planes still have the toggle type mag switches, the dangerous ones because some are Off when up but some have been inverted so that down is Off to fit the American household standard. Up being off is still common for some European countries and was the way many of our planes were delivered, for reasons never explained. Many planes, to get rid of the danger of the toggle switches, have been converted to have key-operated rotary switches for the mags. There are also keyed rotary switches which include a Start position and that combination is handy if your engine has the electrically controlled starter. The advantage of this switch is that the start position is spring loaded from Start back to Both, so the probability of inadvertently hitting the start switch when the engine is running is minimized. Both types can be seen in Spruce and note that some old switches of this combination type have an AD against them. Make sure of what you use.

Magnetos, Magneto Filters, and Spark Plug Wires

Magnetos are Bendix, Slick, or Eisemann. Eisemanns are liked by many because they have no AD's but they are not listed on the certs. The Bendix units are fine if the AD's have been worked. The first Slicks are not overhaulable but the new ones are (many mechanics don't know that). All mags have a recommended time of overhaul which is really an end-of-life for the first Slicks. Some refer to the "cert" for the engine and claim that the Slick and/or the Eisemann can't be used because they are not listed. The Slick did not exist until relatively recently and the Eisemann had quit by the time of the 150's with the O-200 engines. They all do the job.

A special note that applies no matter what brand; both mags on the C and the O-200 engines should have the impulse coupler feature. Many plane manufacturers other than Cessna use the impulse coupler only on one magneto. If you were to buy an O-200 from a different plane, and if it uses the single-impulse plan, you will have to buy another impulse coupler type mag to comply. (The impulse feature does two things: 1. they delay the timing of the spark so that it occurs after the cylinder is on the way down and therefore cannot kick back and 2. the impulse is a spring loaded and when released makes the rotor of the mag twirl very fast and that means a very healthy spark.)

Today, a set of new Slick mags and wires will cost only slightly more than the overhaul price (at the places where we trust the workmanship) of either the Bendix or Eisemann. New Slicks are overhaulable but inputs from two reputed mag experts match; if the Slicks are overhauled to the manufacturer's recommendations, replacing all the parts they say to, their overhaul is expensive to the point that another new set is the only realistic alternative which means you would plan on replacing them again after 500 hours. Believe the need for overhauling is real! The best package buy today is Slicks and their plug harness.

The "official" timing settings were moved from the original 28 degrees BTDC to 24 by an AD against the O-200 which proved to have no merit. That caused a loss of power, the amount never admitted by Continental, so the new cylinders which are strong enough to again allow the 28 degree settings are to be preferred and, we believe, definitely worth the investment. There are at least three manufacturers who make the 28 degree cylinders these days; Continental....and ECI (Engine Components, Inc.) and Superior's Milleniums. If you are changing to the O-200 to get the maximum power, don't throw away the advantage the new cylinders give you.

If the spark plug wire harness is over a few years old, it is suggested that you replace with new. Realize that the spark plug wires at the mag ends are brand-matched to the mags so if you change mag brands, you have to change the wires as well. If you change mag brands during the engine swap, the "P" lead ends to the mags also have to be changed to accommodate the different fittings on the mags. Do a careful inspection also of the mag noise filters and decide if you want to change to new; proper removal and installation at annual time is a rarity because the mag fittings tend to rotate the wire shields, eventually breaking them. A

broken shield strand going the wrong way into the wire can kill the mag's output. In 2005, we verified on our engines that the filters to the mags are no longer required; they were installed in the days of low frequency radios but with new radios there is no benefit. Some leave them in simply because the P lead fittings at the mag end are attached.

Generators:

The C engines and the O-200 use the same generators, from the 12 through the 35 amp size. It is recommended that you replace the drive line cushions as noted in the alternator section, and read the article (Generator History and Cooling) on adding a vent tube which the plane should have had from the beginning, shame on Cessna. Weights of the different size generators are listed there, too.

Alternator

An alternator is highly desirable so work to get one with the engine. It is not necessary to have an alternator since the generator you have on the C-85/90 will work but it certainly is desirable because the alternator provides energy even at idle speeds where the generator doesn't. In the pattern at night, with lights and radios on is when the feature of sustaining the energy draw instead of depleting it is most appreciated.

The first few years of 150 manufacture used the generator, so which you get with the engine is engine-age dependent. The 1967 Cessna 150 was the year the alternator supplanted the generator. Through the years, Cessna added complexity to the alternator system; the overvoltage subsystem is one and it was altered several times through the years. None of us retained or sought the overvoltage system and we know of no detriment due to that decision. If you get the complete harness with the engine, including the later overvoltage system and the auto-resetting field circuit breaker, then use them.

If typical, the alternator will be one manufactured by Ford Motor Company and will be capable of producing 60 amps. Again, beware and stipulate that only an aircraft type alternator is acceptable. Many auto-only alternators have been fitted to our engines "because they are the same". They aren't. I have articles which point out the differences; they are made to turn in opposite directions, the slip ring brushes for the aircraft are harder for less wear and less arcing at altitude, the fan is reversed, the bearings are "lifetime" for the plane version, and so on.

Other changes to be made to accommodate are like the following but for a full story, see the alternator article.

A new #8 wire from the alternator to the bus, routed to the bus side stud of the ammeter rather than trying to splice it to the existing bus wire which goes fuse to fuse. New regulator control wires are recommended. A new circuit breaker and hole in which to mount it. The usual thought is that if the alternator has a 60 amp output, then you have to provide a 60 amp main circuit breaker but this is not so. The output wire must have the ampacity of the maximum output, but the circuit breaker can be less. The field wire can be protected with the fuse your generator uses, or a new 5 amp circuit breaker (and hole) can be added. If you get a Cessna alternator system and the harness, the funny looking round item is a Texas Instruments 3 or 5 amp "auto-resetting" circuit breaker for the field current and must be mounted on the firewall side of the instrument panel, not accessible for manual resetting.

The gen/alternator/tach housing gasket is listed on the engine parts page of the Spruce catalog.....the starter gasket is listed next to it in the column and is there to confuse. The regulator was initially an electromechanical type, with a couple relays but they are no longer available and have been supplanted by a solid state unit, also findable on the alternator page of Spruce.

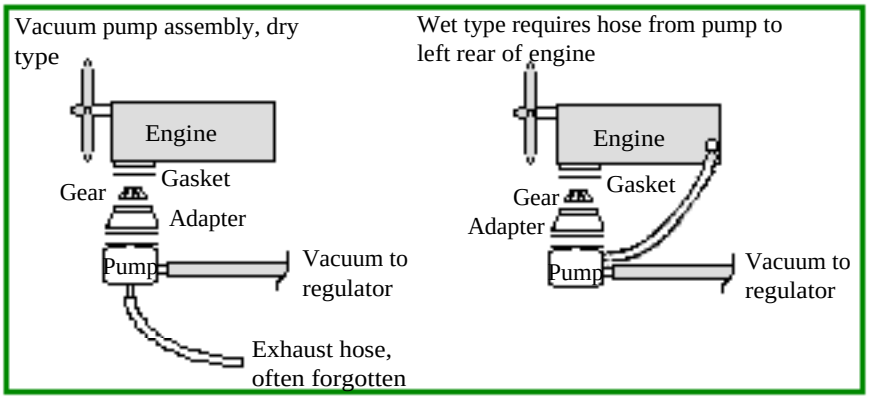
Plan on using new shaft cushions. See the Engine Parts page of the Spruce catalog...items 4 and 5 of the Generator attaching parts.....these comprise the rubber cushions and cushion holder to take the backlash shock. The rubber cushions and holder are supposed to be replaced as a set every 500 hours. For a few dollars, this set is available. The future Continental solution for a new style cushion will cost $1,000!!

Alternators often have filters, either internally or meant to be mounted on the firewall. If they come with the unit, use them. If they don't, see what happens without them before you buy them. Some combinations of radios and intercoms and alternators will create a howl in the headsets. You won't know until you fire it

up. If you have an alternator howl in the headsets, you have the options of living with it or using filters to kill it. Since all filters you will find in aviation catalogs are for undefined frequency bands, none of which match your need, the cure may well be a new filter, a large Pi filter, right at the DC input to the radio or the intercom. Radio Shack Aviation Supply makes a good 15 amp inline filter that has cured several howlers.

Vacuum pump

For many, it is desirable that a vacuum pump come with the engine. The pump can be either a wet (uses oil fed to the vanes via its mounting and so is longer-lived) or dry (uses dry carbon vanes and has a short lifetime, on the order of 200 hours....if the dry vacuum pump that comes with the engine has more than 200 hours, replace it with an overhauled or new unit). You are not required to use the vacuum pump but some really need it because their plane is instrument qualified. Venturi driven gyros don't fully erect until the plane's speed is near cruise whereas the vacuum pump driven gyros can become erect and usable before takeoff. If you mount either pump, then a hole has to made in the cowl front and a piece bumped (formed) to cover the pump protrusion and hole. The STC gives you a rough idea of size and position. If no vacuum pump comes with the engine, it may be that you will need to have a cover and gasket fabricated to cover the hole where the pump would normally mount. Some owners are happy with the venturi vacuum systems now on the planes and so remove the vacuum pump, mount, shaft and gear and seal its mounting hole. (The Continental parts manual gives the part numbers of the gasket and this cover.)



Extra hoses are necessary for the vacuum pump and other things that will be needed are the firewall fittings, a regulator (about $200 these days) inside the cabin, and hoses to and from the new regulator and the instruments and new filter. The regulator is a necessity because the pumps create a vacuum of about 7 inches of mercury whereas the instruments can utilize only four to 5.5, depending on age; excess vacuum means excess gyro speed and shortened lives of the instruments. An air filter is also recommended.

Carburetor, Marvel-Schebler

The dash of the part number for the Marvel-Schebler Carburetor for the O-200 engine is used to indicate compliance with AD's such as the venturi and metal float. Make sure you get the right one or plan on a $500+ exchange. The AD for the change to the metal float must be proven as well, even if it takes dismounting and looking. If the engine you find has not been used for a number of years and has no proof of the metal float, plan on taking it apart for sure because the non-metal float disintegrates using today's fuels.

The information regarding the venturi change has typical errors. The Marvel carburetors have dual venturis, one nestled within the other on the original units and each made independently. The new dual venturis were cast together. The AD mandating the single piece venturi initially did not include the modified nozzle which turned out to be necessary on many of the carbs modified. It was found that some planes with the new single piece venturi set and original nozzle were using twice the fuel. Precision Airmotive (engine division), the license holder for Marvels and maker of the single piece venturi, developed a replacement nozzle to match. Later, the FAA came back and said.....if the two-piece still works, use it. If the carb has the one-piece venturi, make sure it has the new nozzle. Some outlets, such as Spruce, are "behind" and will sell you the one-piece venturi but know nothing about the new nozzle. Careful. Talk to Precision.

A rebuilt Marvel-Schebler for the engine is $500 to $600 if you have a rebuildable core, nearly $1,000 if you don't have a rebuildable core. Getting a good Marvel-Schebler with the engine is not a trivial quest. Some Marvels come with a coil spring around the throttle shaft so as to advance the throttle toward open in the event of a cable breakage. Some come without. Continental requested that one licensee take it off but did not tell the other licensee to do so. Some users like the idea of the spring; none know if it will work.

Air Box and Induction Spider

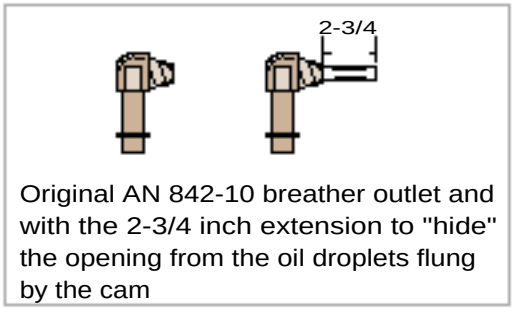
The air boxes and the air filters for the C engines are the same as for the O-200...some of them; the slight changes can be accommodated. Some of the planes use the airbox which dumps the unused alternate air (carb heated air) exhaust between the cowl and airbox and some have the pipe which extends from this opening, the latter pipe requiring an opening in the cowl. The later 150's have a three inch diameter carb heat air inlet and outlets to/from the muffs of the mufflers so the hot air inlet to the air box may need to be matched to the SCAT tubing which connects the hot air from the muffler to the air box. There are adapters which make this easy. If you get an airbox with the engine, use the best one, or overhaul the one that looks best; overhaul kits are about $40 and should last the life of the plane because they are so much better than the original shaft/bearings. The new airboxes designated as O-200 type should have a set of Teflon bearings.

Because the new engine mount shifts the engine slightly to the right and down, you may need to trim the airbox/filter inlet hole in the cowl to accommodate the different droop of the mount.

There used to be only one induction spider version (the device to which the carburetor is attached and from which the induction tubes are routed) but now there is one part number for them for the C engines and another part number for them for the O-200 engine. Side by side comparison shows up only one difference; the unit for the O-200 has a primer opening on both the left and right sides whereas the one for the C engines has only one opening on the left. Since the opening on the left is the one used on the 120/140/140A's, this is also a "use either" decision but don't forget to carefully verify that the plug is correctly installed in the not used primer hole and that it is leak-free. Early engines have the primer tube feed a stream of fuel in and let it splash off the other side but later engines have a nozzle at the end of the primer line for creating a spray into the spider for better fuel atomization.

Breather.

See the Breather Fitting Mod article about the modification to reduce oil loss and keep the belly clean. It shows how, has all the data and the Cessna part number of the modified part. This simple change will make an amazing difference in reducing the amount of oil which appears on the belly and it is sanctioned by Continental for the C engines and the O-200. For reasons known only to Continental, they never put the part number for the revised unit on their parts lists and neglected to tell the users, us, about the benefits. All of the later O-200's were built with the outlet having the extension, so you won't know until you remove it and look.



Original AN 842-10 breather outlet and with the 2-3/4 inch extension to "hide" the opening from the oil droplets flung by the cam

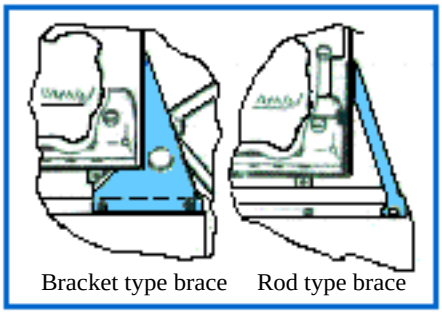
Those of us who own the planes have a miniclub and all of us converted to have the extension a long time ago; recently, one member overhauled his O-200 engine but did not re-use the outlet with the extension because it had been dinged. After every test flight with the new engine, he would check oil consumption and the residue in the oil separator on the firewall and kept finding a high usage and what seemed a worrisome excess of oil in the separator. He fixed the outlet with the extender, installed it, and....virtually no oil in the separator and very low consumption when checking the level!

Because many take this opportunity to create a new breather tube, this is a good time to mention that your breather tube should have an "ice hole". We position the ice hole at the point where the breather tube passes closest to the muffler or exhaust stubs to the muffler. Nothing special, a slot 1/4 X 3/8ths or several holes equivalent on the top side of the tube....the ice hole allows the breather pressure to vent in the event the breather water vapor freezes the outlet end closed. Failure to have an ice hole and having the tube plugged with ice will cause oil to be blown out the prop seal and be deposited on the windshield.

Muffler

For a long life (of you, not the plane), the STC's require/suggest changing to the 150 style mufflers. The pancake style mufflers are simply too leaky via cracks and all of those of us who had them first recall that welding cracks was an annual event. As far as we know, the O-200 is not authorized to use the original blast tube style non-mufflers used on the first planes. Discuss the options with your A&I.

150 muffs require new holes in the cowl if you are replacing the blast tube type of exhaust stacks (and if you now have the pancake style mufflers, sometimes those holes need to be modified a bit)
150 muffs require a stiffener to the existing baffling on the left, one of two types



Bracket type brace Rod type brace

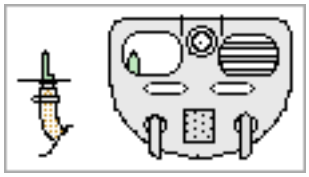
150 exhaust pipe extensions require a stabilizer secured to an oil tank stud
Newer 150 muffs had larger air inlet and heated air outlet hoses for more heat (3 inches Vs 2 inches)
Newer 150 muffs with the 3 inch heat inlet and outlet sometimes use the flush air inlets, not the scoops
The Cessna 150 muffler sketch in the 150 parts manual is very good

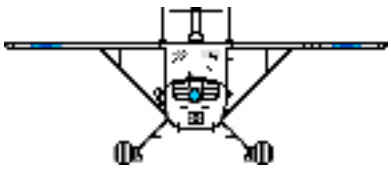
Because the new engine mount shifts the engine slightly, you may need to trim the holes in the cowl to accommodate the exhaust pipes. There are endless arguments as to whether the slanted openings of the outlet pipes should face forward or to the rear. Both work, the engine doesn't seem to know and I will never ask.

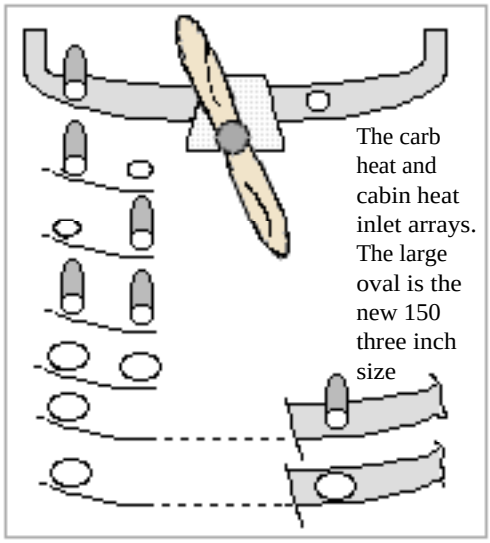
Inlets, carb heat, cabin heat and carb air filter

If you look at the front of the engine cooling inlets on 120/140/150's, you will see many different arrangements of the inlet ports for the carb air heat and the cabin heat. There are so many versions that you soon run out of "why did they do that?" and give up. Some have both inlets flush to the baffling, some have one flush and one with a wind catcher called a scupper type, and some have two scuppers and these combinations can be complicated by their position right or left. Some installations have the left inlet to the muffler creating carb heat and others the opposite.

There are the miniature scupper shapes (they look like the tiny air inlet scuppers on ocean liners) and there are those inlets which are simply flush openings in the horizontal portion of the baffling in front of the engine, going from the engine to the cowl. Sometimes, one on one side of the prop and the other on the other side of the prop, sometimes both on the right (most common) and sometimes flush and sometimes two inch diameter and later on the 150's, three inch diameters. This STC makes the point that the scupper type inlet will give you more air volume, but the temperature of the warmed air will be lower than that from a flush inlet and they pass along their preference in the STC that less air, hotter, is better when you want lots of carb heat so they specify the flush inlet. The revised Thompson Air STC states that the scupper should not be used for carb heat.







Artistic license is used to indicate the scupper type air scoop position, front and side view for carb heat or cabin heat air inlet. The other stylized figure is to show the different combinations of the inlets. Note that the larger ovals, all flush, are meant to depict what you would find on 150's which have the 3 inch diameter cool air delivery tubes to the mufflers. Because the velocity of air behind the prop increases the farther the measurement point is from the center, the scupper on the extreme right of the right air inlet receives and ingests the greatest amount of air compared to other positions, such as any on the left and any closer to the centerline. The left side most inboard scupper or flush opening inlet would gather the least air and provide the hottest output air from the muffler muff. I have learned to have no opinion as to which is "best" for the carb heat nor do I know how anybody would except at Cessna. These positionings lead to the reason that sometimes the left muffler feeds the carb heat and sometimes the right and so on. Get agreement before cutting the SCAT tubing.

It is a shortcoming of Cessna and Continental that the desired temperature of carb heat into the air box is not stated so that one could confirm they will have enough hot air when needed. At runup (1700 RPM), the typical carb heat drop is about 100 RPM's.

Baffling

Unless you are replacing a -14 or -16 C-90 engine with the O-200, you are going to have to do some cutting and fitting of the baffling. This will take a lot of cutting and fitting and lots of putting the cowl on and taking it off again. The baffling that came with our O-200's is what we have used. Others used the baffling of the C-85. Some engines baffles were not modified to have the intercylinder baffles...see the article on how to make and install them.

If you look at a C engine installation, the opening behind the cowl grilles is full sized; for the O-200 150, the front openings are larger, with no grilles, but half? blanked with a vertical piece of baffling which covers something over half the fins of the cylinders. No one knows why the difference. but we all kept the vertical baffling like the 150's. Vibration against the fins of the cylinder cause the top edge of these baffles to appear like lawn rake teeth but they are easy to replace.

One more point about the C baffling for planes which used the straight pipes, called blast tubes, instead of the later pancake mufflers; the open annulus around the exhaust pipe which leads to the blast tube shrouds for carb heat or cabin heat should be closed so that no cooling air is lost through that rather significant opening. This step was not done on a lot of planes we see which have converted to the 150 style mufflers.

The C engines have conformal shrouds displaced a little over half an inch in front of the oil tank. Air which is fed into the two oval holes below the crankshaft moves past the oil galleries (yes, galleries, not galleys) on the engine bottom and then is directed to flow between the oil tank shroud and the oil tank, assisting cooling there. The O-200 oil tanks do not have similar shrouds but the air through the oval holes past the galleries and around the oil tank is important, so make sure the oval holes are properly flex baffled as well to fill the gap to the cowl.

Mixture Control

The mixture control for the Stromberg carbs on the C engines was routed from the instrument panel straight through the firewall to the Stromberg's left side to allow the movement of the mixture control arm to be front to rear. For the Marvel-Schebler on the O-200, the mixture control cable must approach from the carb's right side because the movement of the arm is left-rich/right-lean (don't even think about reversing this by trying to use the mixture control cable for the Stromberg). This seems simple, but usually requires a new mixture control cable because the old one is too short. Do a good job of measuring

before ordering, and get under the panel to see where the cable has to be routed to not interfere with the control column assembly. Comply, too, with the new FAA-mandated knob color coding and shape.

Many take advantage of the opportunity by getting a vernier type (this is the type where you can both push-pull for gross changes in mixture, and rotate a secondary knob for fine adjustments-----just like a Bonanza!) cable but others like to stay with the Cessna 150 type mixture control cable. This can be another "come with?" item when you buy the engine but be aware that it may not be long enough and it may be badly worn. If you don't want the vernier type and you didn't get a usable original with the engine, there are ratcheting control cables like those on some 150's which are available from catalogs, and you want at least a ratcheting type to prevent creep. The vernier type is infinitely variable in position, whereas the ratcheting type can only be positioned one notch to another.

The mixture control in the carburetor directly controls the amount of fuel to the nozzle so it is usable throughout the range of RPM's. If using 100LL, the mixture control is an even greater benefit to reduce lead buildup on the plugs right after start, during taxiing and runup.

Throttle

Make an assessment about your existing throttle cable assembly and determine if you want to replace it. Many times you must because the new mount shifts the attach points. Since a lot of people don't change because they want to keep the big knob, be aware that you can remove the big knob from the old and put it on the new (some people really like to keep the 150's white matched set of knobs) If you buy a new cable with a small knob but want the big one, Spruce sells the big knob by itself, black only. The new push-pull throttle assemblies come with a slippery plastic liner inside the outer spirally wound wire housing, making movement much smoother and the need to always use the friction lock on the throttle to maintain position. Often, there is damage to the cable housing at the firewall or where the sheath is attached to the engine mount, so look there. When you order a new cable, also order two steel sleeves which will be swaged on the cable, one where it goes through the firewall and the other where it is grasped by the clamp on the engine mount just aft of the carburetor

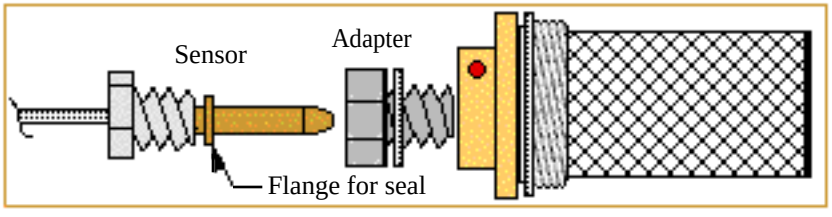
Tachometer

It is preferred to get the tach with the engine, especially if it is the recording kind with the engine hours on it. If you must use the old tach for the 85/90, be aware that you can mark it up with the new engine limits, or you can send it in to one of the instrument marking outfits and have it done on the face so it looks as though original for the O-200. The limits for the markings are stated in the STC and 150 manual.

Oil Filter or Oil Cooler

On the left rear side of the engine, there is a triangular-shaped cover over an oil bypass. Under the cover is a pad to which can be mounted an oil cooler (Harrison) or an oil filter. The F&M (supplier and maker in Texas) STC-ed oil filter has been installed on a lot of planes and is a great addition. You can always see the ad for it on the back pages of the Newsletter for the 120/140 club. An article: "F&M Oil Filters" is on the site.

Scary things



One of our group had the O-200 upgrade done by a long-time "professional" rebuilder and FBO owner. After several trips over mountains, we found that the "professional" rebuilder had jammed the oil temp sensor bulb retainer into the oil screen assembly, leaving out the Oil Temperature Bulb Adapter and its sealing copper gasket as indicated in the assembly figure. The oil temp sensor flange must mate with the internal surface of the adapter to provide a seal. This type of thing is another good reason to make sure you have the parts books for the plane and engine! The figure indicates the parts buildup which should be there, including the bulb adapter. For a better explanation, the articles on the site for the Oil Temp Assembly

and the Oil Screen Assembly. Scott goofed and altered the sealing surface so read the article and make sure you use an adapter with an internal surface which mates with the surface of the oil sensor. If you buy a new Scott meter and sensor today, do NOT use the old adapter, but do use only the new adapter which comes with the meter assy.

The screen is sometimes removed if the O-200 installation included an oil filter. Determine whether the screen is there....it needs to be if you plan no filter. To purchase a screen sets you back about $125!

Many elect to have the F&M spin-on type filter mounted to the bypass pad at the left rear of the engines. If you do, decide also whether you want to remove the screen or leave it in. Your choice. Leaving the screen in when you add or change to the filter means that you should always remove the screen at oil change time and monitor its catch and that of the filter. Make sure your new oil change checklist includes checking the screen if left in (mention it even if the screen is removed). This point is accentuated because of experience; my Oklahoma FBO overhauled engine's screen had apparently never been removed and cleaned since its overhaul 300 hours before...they added a filter and a filter catches it all, right? No. It was so covered with big carbon clods that it was a wonder enough oil could go through.

Oil Pressure Relief Valve Assembly

The oil pressure relief valve is at the extreme end of the pressured oil delivery channel; all along the way of the two galleries, oil is diverted to bearings and lifters and all of the leak oil. That oil forms a cloud of droplets which serve as the only lubrication of the connecting rods and pistons. The constant manipulation of the oil relief valve spring fatigues it and the oil pressure decreases.

The oil pressure relief valve assembly has often been "field modified" to have washers in it at the end of the spring in order to increase the oil pressure indication. How many washers can be in the oil pressure relief assembly? Every time I run across the Continental rep, I ask what it is that authorizes the use of washers and get his verbal reply...."as many as needed", but when I ask for the document that states that even one washer could be used to increase the oil pressure, he promises to get back to me but never has. I have never been able to find any allowance for washers in the stack. Good insurance when ordering the parts as suggested below when you get the engine...order a new spring and plunger for the oil pressure relief....the entire assembly does not have to be replaced, just the two parts. And throw away the extra washers. Those who don't do enough research tend to believe the statement that the oil pressure for the O-200 should be 30-60 PSI. They leave off "for the green range" which means cruise RPM's. The actual allowance is a minimum of 10 PSI at warm idle and as high as 100 PSI for a very cold oil start, with the "green operating range" to be 30-60 PSI.

First Start, First Oil Pressure

The first startup is.....tense. You would like to have almost-immediate oil pressure just as for an in-service engine. It will not be so; you will hypothesize about various tricks and will do as we did.....squirt oil everywhere and attempt to get pressure by taking out the plugs and motoring the engine using the starter. No, don't bother. We oiled all the accessories when they were out, and removed the plugs at the front of the oil galleries at the front of the engine and squirted oil down these oil galleries and put in a bit in each cylinder when the plugs were out and, eventually, fired up the engine and sweat for the several long seconds before there was pressure. Whew! And then all was well. Just motoring with the starter, even with the plugs out, will get you no pressure.

See the article on "Loss of Prime and Oil Pressure" to understand the best method of ensuring quick oil pressure at the first start. All who have used the recommended method have been pleased with the results.

Many feel better if they fill the oil pressure line/hose forward of the firewall with oil to get a "faster" indication, but physics is physics and whether there is air in the line or oil, the same pressure will be felt by the Bourdon tube of the indicator.

If new cylinders or a newly overhauled engine is what you get, then adhere to the manufacturer's recommendations as to breakin techniques and especially use the oil they tell you to. You will see many stories about how xyz ignored the use of straight mineral oil and used detergent type right away but no one ever prints the long term results and ignoring warranty directions is foolish in our camp.

Starting The O-200

The Marvel carburetor has an acceleration pump which is often used in lieu of the primer when starting. Better is to use the primer because it feeds fuel into the induction spider above the carburetor. The acceleration pump projects fuel from a jet below the throttle butterfly. Most who use a couple of thrusts of the throttle before engaging the starter use too short a jab; If you use the throttle/acceleration pump option before or just as you start, be aware of the advantage of pushing the throttle all the way in so that more of the acceleration jet goes beyond the throttle butterfly up into the induction spider. Unless you do this, most of the fuel you believe you are injecting with the short jabs is actually deflected back down into the air box when it strikes the bottom side of the throttle butterfly. If you want the greatest effect of the jet of fuel at start when you pump the throttle, push the throttle in fully and briskly and all the way out just before you turn the engine over. We have found that the engine primer gives a faster start when pushed in as the engine is turned over, and use the quick throttle thrust only when the engine is still warm, but seldom.

With a carburetor removed from the airplane, split open, and all visible fuel dumped, I manipulated the carburetor throttle and was very surprised to note there was still fuel in the accelerator pump well because there was a tiny jet of fuel projected several feet above the carb and that could be repeated two or three times. The message is....the engine can run for a few rotations on just the fuel from the acceleration pump, so never trust that the carb is empty because the fuel selector is Off and the mixture control was used to stop the engine.

The carb has a mixture control that is useful from the ground up, and which can be used for shutdown. That means starting is bound to be different from the C engines with the Stromberg. One of the first steps for starting now has to be to ensure that the mixture control is full rich. You will forget this a few times and look foolish when the engine fires for a few revolutions and quits.

Ground Mixture Control

Being forced to use leaded fuel such as the 100LL will lead to leaded plugs in a hurry if the mixture control is not used on the ground and in the air. While taxiing, I found it difficult to determine the best lean while on the move but learned a trick that has worked well. Elsewhere in this writeup is the mention that, on shutdown from idle, the engine will surge by 10 to 25 RPM's when the mixture control is pulled to the shutoff position because the engine is deliberately set to be quite rich at idle so as to not be lean when there is more air coming in on final approach. To use that characteristic of a surge, set the throttle to about 1000 RPM's before taxiing and find that highest point of rise with the mixture control. Reduce the RPM's and then taxi.

Shutdown

For the Marvel carburetor, cool the engine at about 800 RPM, lock the throttle, pull the mixture quickly and fully out. This leaves the throttle at the correct position for starting and warmup. After pulling the mixture control to lean, note that the engine surges by 10 to 25 RPM's from idle to confirm that the idle mixture adjustment is correct. Do not shut down by cutting off the ignition; if you do, you will sooner or later see the engine running and clanking backward, not a pleasant sound and you can not stop it.

A lot of people have guessed that using the mixture control to shut off the engine actually depletes the carburetor of all fuel but that is not so, nor does shutting off the fuel selector totally deplete the carburetor; fuel remains in the pump section of the carburetor and the engine will start and turn a few revolutions with the fuel selector off and the mixture control full off if the throttle is pumped, the prop turned and the ignition hot. You will confirm this the first few times you fail to return the mixture to full rich before you try to start. The reason for mentioning that hidden fuel is....you cannot ever assume the engine won't run if you turn the prop "because the carb is empty of fuel". It won't be.

Talk to your FSDO

With the STC you choose and an incomplete but skeleton 337 in hand, take your mechanic/A&I with you and go talk to your FAA FSDO people. See what they say as to whether other requirements are necessary, find out if others they know of have done a conversion and be sure you are explicit about complying with the STC (the A engine). Make notes if there are any special requirements of the FSDO. When you are "done", take the STC, the 337, and any other backup information such as yellow tags (recall that you made

notes when you went to see the FSDO before you bought your O-200 so you know what they want to see, right?) to the FSDO. An appointment is necessary since the event in New York.

Our understanding was that the STC and 337 would be reviewed by the FSDO, the 337 approved if all is okay, and a copy of it would be sent to Oklahoma to the FAA there. In my case, that is exactly what happened and the person at the FSDO signed my 337, made copies for his/their records, returned the other stuff, and sent me on the way. Others at the FSDO have stated that they did not want any paperwork and one A&I flatly refused to fill out the 337 for the engine he installed. After the installation is a bad time to find that out. Determine what is needed and who will do what at the first FSDO meeting. You can make out the 337, but the A&E needs to sign it.

Soon after the FSDO visit, I made a copy of the signed 337 and put it and a copy of the page or two of the STC which talks about performance (engine RPM's mostly) in the plane since proof of the STC authority is supposed to be in the plane, as is the "operation manual" page (s) from the STC (there aren't any).

337 Sample

Based on the non-results of the 337's changing the plane features in the FAA record, consider that the 337 is more for you in the future as a good record and so list things you might want confirmation on later.

The typical 337 has an open text block and a heading: Changes
Note that the following is just a sample, not gospel.

Removed C-85 engine
Installed Continental O-200A, serial number 64XXX-X-A
Engine installed on new 140A mount, Cessna part number 0451111
Installed McCauley MCM 6950/1A100 metal propeller (the STC-recommended would be 6952 pitch)
Installed Marvel-Schebler MA3SPA carburetor (add the specific part number)
Installed 1967 Cessna 150 carb heat system
No oil cooler used
F&M STC'ed Oil filter installed at oil bypass pad (list the STC number)
.
Electrical modifications made to comply with Cessna 150 alternator system.
All baffling from Cessna 150- 1967 cut to fit cowling
Intercylinder baffling same as manufacturer's originals
Cowlings unchanged. Nose bowl modified to accept vacuum pump (and the 150 mufflers?)
All engine instruments marked in accordance with Continental specs
Exhaust system is the same as the Cessna 150, 1967
Operational Limitations changed from C-85 specs to O-200A specs
All modifications in compliance with AC 43-13-1A and per the necessary data from STC 547EA for the Cessna 120/140/140A as a guide.
Static runup confirmed engine/prop within limitations
Flight test accomplished to verify operating limitations.
Mention weight and balance (the engine weights are about the same but changes to generator and starter can make a difference)

Other

When some of the STC's were new, they suggested the removal of the grilles in the cowl, the installation of the lip on the front outlet edge of the bottom cowl and opening the oval holes below the prop shaft into grossly oversized "bugeye" holes. The intent was to ensure cooling, but the STC owners later found out that the high temps they were seeing after the change were due to the normal high heat from an engine not yet broken in. Those bugeye holes proved to be overkill and have not proved necessary for adequate cooling. Most of those who later made the installation have not installed the lip and have left the grilles in place, have not made the ugly bugeyes but ended with excellent results and the usual "100 degrees over ambient" running temperatures. None have reported a problem by leaving off those options. Follow the recommendations of the new issue of the STC.

We have found that most mechanical tachs lie, some a little and some a lot. When you are ready to do the static runup for the STC-mandated maximum, plan on borrowing and using a digital tachometer if you

want to be accurate. The mechanical tachs lie most when they are cold so take advantage of a digital tachometer and plot the digital readouts and the plane tach numbers both when the engine is newly started and again when it is fully warmed up and later when it is flying. Its nice to know what the offsets are.

Everybody we know who has converted to the O-200 engine on our planes has found that the oil temperature guideline of "100 degrees over ambient" holds true....but...all of our planes have the cooling air blast tube pointed at the oil temperature sensor and oil screen housing and the STC requires it. This is mentioned because some planes have never had it or they have been removed on some planes or blocked for winter and forgotten in others. Cessna made life a bit more confusing by passing an error in some of the parts manuals where they "forgot" to show or call out the tube. This tube, if you don't have it, runs from the back side of a hole in the rear vertical baffling on the right side of the engine to within less than an inch of the oil temperature sensor housing. You need the blast tube if you want to see the same oil temperatures we do. The original tube, no longer available, can be replaced with SCAT tubing and adapters (Spruce again).

Little parts (that can make you cry)

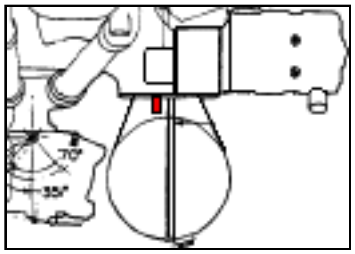
Parts required or recommended...Engine Parts page 260 of the '05 Spruce catalog for most of these.

flexible baffling material, original type or the new red but not the red without fiber support
firewall grommets (throttle and mixture control re-routing)
muffler attaching nuts
A Cessna 150 oil pressure hose engine to firewall...size 2.
Mount-to-firewall bolts and nuts and washers. Those for the 140A mount are NAS145-15 four each and one AN5-6A for the top center bolt. See pages 68 and 69 of the Cessna 150 data (their figures are better).

Engine-to-mount bolts and cushions and spacers and washers for the O-200 cost about $240 for a new set. See the blowup of these parts and note their prices in the Spruce catalog...page 260 in '05. It is worth your while to make sure you get them with the engine if possible but do plan on replacing the rubber parts with new if they look tired. These can be purchased separately.

Be sure the engine has the brass fitting to which the oil pressure hose/line attaches because it has a flow-limiting 0.060" hole in it. A fitting which looks like that one except with a standard hole is not a good part to use because the loss rate is so much greater in the event of a leak in the oil pressure hose/gage subsystem. The fitting (AN 823-2B) can be filled in and a 0.060 hole drilled to react like the original part.

Pay attention to the ground strap and replace it if worn or has a lot of strands broken. Note, too, where it should connect because many installations are made useless with the ground strap connecting the front side of the mount to the back side of the mount instead of from a big vertical stud on the engine case bottom left rear side, shown in red in the left figure. The parts manual shows, barely, four little spring clips for the engine to mount ground, but we have never seen them.



Gaskets:

It is recommended that the engine valve cover gaskets be converted to the R.E.A.L. brand valve cover red silicone gaskets, finding that the usual gaskets simply leak and leak and leak less but still leak. As a step in closing up the engine, take the time to straighten the contact flanges of the valve covers because they will have been beaten a bit, and they won't present a constant surface to the gaskets...do this even if you decide to use the R.E.A.L. gaskets and pay attention to the R.E.A.L.--recommended screw torque values because excessive torque will cause leaks by squeezing out the gasket material.

Individually these are the gaskets:
generator/alternator (its actually a gen/alt and tachometer housing gasket)
the starter gasket
magnetos (you have two, remember, and ordering three is good)
tach housing (actually part of the gen/alt gasket),

oil temp sensor and oil screen gaskets (these are copper crush gaskets AN-900-xx)
carb to airbox
carb to induction spider
carb gaskets if you elect to disassemble for a look-see
exhaust gaskets (use the good ones, the so-called "blo-proof")
vacuum pump (not sure where these are available)
left rear oil bypass/oil cooler/oil filter if you install either

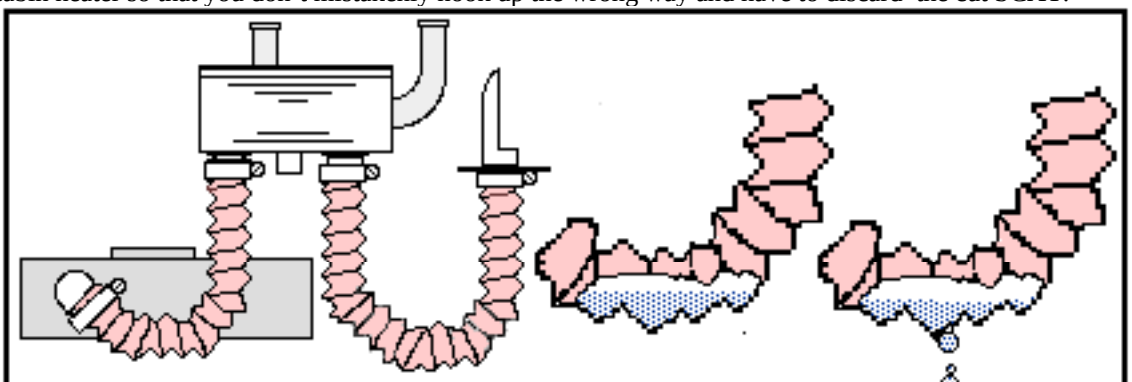
If you get the newer 150 mufflers with the engine, then they may have the 3 inch air inlets and outlets which means the airbox hot air inlet and the cabin heat inlet fittings will have to be changed to accommodate, not a difficult task.

Hoses:

Fuel...from gascolator to the carb. The existing one will probably be a couple inches short and likely to be old. You can use the old one as a measurement guide, and the fittings can often be re-used. Muffler-dependent, your A&I may advise Firesleeve over it.
carb air and cabin air SCAT tubing..see SCAT section
Short 5/8ths ID hose from the breather fitting to the breather tube
Hose or Al tube, 5/8ths ID, as the breather tube to near the bottom rear opening of the cowl
Wet vacuum pump requires one oil return hose, dry vac pump does not
Either vacuum pump, if used, requires a hose/fittings to connect to the vacuum system in the panel.
The dry vacuum pump requires an exhaust hose, often overlooked
Use a new Cessna 150 oil pressure hose, engine fitting to firewall (C engines had a copper tube which ages and work hardens). Cessna 150 parts catalog, page 30, item 16, part number S1168-2-15 (recently changed, so make sure size two). (It is size two for the right one)
Hoses for the induction tubes (unless recently overhauled) and for these, plan on re-tightening the clamps at the first oil change because they tend to yield and reduce the clamp tension.

SCAT Tubing

SCAT tubing for air inlets, for exhaust to heater, and for carb heat. Note that, if you have the newest 150 mufflers, the hose (s) will be of larger diameter, three inches instead of two. Find out which size SCAT you need for the installation before buying! We all use the orange (they call it red) SCAT tubing, although the less expensive and lesser temperature capable SCAT could be used for the cabin heat inlet. Discuss with your mechanic which air inlet and muffler is to feed the carburetor and which is to feed the cabin heater so that you don't mistakenly hook up the wrong way and have to discard the cut SCAT.



An often-forgotten good idea the old timers knew. The SCAT tubing to the muffler and from the muffler to the carb heat and cabin heat inlets should have low point drains. Most make small slits at the lowest points on the SCAT tubes to ensure that no rain is captivated in the tubes (or ice in some locales).

Making these slits takes intestinal fortitude the first time but we are all believers because our timing to do it was after a wash, a careful wash, and the amount of water that came out of the tubes was....surprising. With the slits, you will never ingest a slug of water in the engine, and you won't get sprayed in the cabin

with water when using the cabin heater. A few owners have been surprised by what the slug of ice from the tubes will do when things warm up a bit!!

Sources:

The Continental C and O-200 parts and overhaul manuals...are all available from Univair and Aircraft Spruce and Sacramento Sky Ranch, as are the Cessna manuals for the plane such as the priceless Cessna 120/140 parts manual.

Light Plane Maintenance, July '95, has the O-200 article which is so pertinent, lacking only an update as to which cylinders can again allow the desired 28 BTDC settings. This article, especially, should be read since it affects horsepower. Light Plane Maintenance of February '98 has the article on the alternator cushion status and changes if you want to know the why, but the information in the articles on the generator and the alternator on the site will explain how and why.

Fresno Air Parts 520 West Kearney Fresno CA 93706 Cash only, best resource for true engine parts, such as the gears and all gaskets and oil pressure springs...see their ad in the Trade-A-Plane pp3 but realize they have much more than listed there. Ask them.

Fresno Air Parts: 637083 oil press spring (recommended) 2114 valve plunger for oil press relief

Aircraft Spruce catalog The URL for Spruce is: WWW.Aircraft-Spruce.com.

air box
exhaust nuts and air box repairs and induction spider
cowl chafe seal
SCAT
Copper 1/8th tubing for primer line (same as from your hardware store)

See page 28 of the Continental Overhaul manual for the best figure of the engine to mount materials.

Tachometer: Mitchell model D1-112-5023. Aircraft Spruce and other suppliers carry them. It comes with a removable bezel and decals so you can put the green arc and red radial appropriate for your engine directly on the face of the instrument. This info from the net, not experienced by us.

Univair and now Spruce offer the mount, sometimes in stock, sometimes not.

STC

There were two STC's (Supplemental Type Certificate) extant for at time mine was changed. The "Emmett" one is the one we used, now the Thompson's Air.

The pages of the STC package you get vary from readable to readable with difficulty to some that are very difficult to make out, having been reproduced either on a very tired copy machine or with the copies made from copies made from copies. Not much is lost because they have very little information so you get a chance to make up some of the changes.

The Rice STC was not findable on the FAA's STC site so I am going to remove the pertinent Rice details. If anyone has a Rice STC that has not been used but would like to read the several pages of critique and guidance, ask for it. I have left the comparison information in the following table.

Comparisons:	Thompson's Air STC	Rice STC	Comments
Cost	$200 as of 2005	Unknown	
conversion instructions	poor	very poor	
New hardware to attach the mount to the firewall.	Generally noted, with choices	no mention	Recommend using new bolts and nuts. 50 years is enough for the old ones and the new mounts take a different length.

Engine A, B, C	only A mentioned	only A	see this article for explanation as to the differences of the B and C models
Propeller	Three possible models	Only one model permitted	If you buy an engine with a prop which is not allowed on the Rice STC, use the Thompson's Air STC.
Static RPM	A different range for each, much expanded from the Emmett version	2425 +/- 50 RPM's (range of 100)	There is no mention of temperature, air density, altitude or any other factors.
Ignition timing	Not stated	Not stated	If you use the old cylinders, you must adhere to the AD for the 24° BTDC limit. If you use new Millenium, Continental or ECI cylinders, you can revert to the 28° BTDC for greater power.
Comparisons:	Thompson's Air STC	Rice STC	Comments
Magnetos			The world has changed since the STC's were created. The Eisemann mags, Bendix, and Slicks are all usable but make sure on the front end that they are acceptable to all involved.
Mixture control	Noted, and part number specified	Not mentioned, but must have	Neither explains that the new control has to snake in front of the T of the plane control assembly and so must be secured out of the way of the T
Oil Pressure	Green arc to be 30-60 PSI	30-60 PSI noted, green arc not mentioned	At idle, with hot oil, as low as 10 PSI is permitted, as is as high as 100 PSI when very cold oil is in the engine
Baffling changes	Uses C-85 or C-90 baffling.	Extensive (no practical knowledge as to utility)	With the new 140A engine mount noted, the baffling has to be trimmed to fit inside the cowl.
Instructions or hints in the STC	A few	Very few	This article contains many more than either. The difference is that I kept notes while doing the conversion.
Part numbers or parts/accessories			Some changed since the STC's were written.
Alternator Generator	Nothing mentioned	Good writeup except for the items noted in this article	All the generators, 12/15, 20, 25, and 35 amp can be used on the engines.
Vacuum pump	Acknowledgment that there will need to be a hole cut in the cowl to accommodate and a sketch of a cover which can be made over it	No mention of a vacuum pump.	Note the sketches in this article, especially about the hoses required if you use the pump or the sealing of the pump mount hole in the engine case if you do not use it. Note that there are two types of pumps
Carburetor Heat Inlet selection	Callout for which inlet but no position	A callout for the type, flush, but not the position for the inlet	Discuss with your A&I before cutting tube to hook up carb heat and cabin heat

Info:

Light Plane Maintenance, July '95, has some pertinent information about the O-200, including the various starters available, both mechanical pull and electrically controlled. That same article explains about the differences in the cylinders which permit the best spark advance, and so the best power. A more recent (2005?) article from LPM was included in the International Newsletter, but it has many errors and misstatements.

From Randy Thompson:

I am the holder of STC SA547EA. It used to belong to Emmett and Buroughs. I have recently made several changes to it that make it more logical.
1. I have added the Sensenich 69CK Propeller to the list to make three possible propellers. This propeller is used on many 150's and may be the one obtained in a firewall forward purchase.
2. I have done away with the bug eye modification.
3. I have expanded the static RPM limitations for the different props. The 1A100 now has a limit of 2475, increased from 2450. The 1A101 now has a max. static of 2600 RPM. The sensenich 69CK has a static of 2470-2320. The 1A101 is the best choice as it will give the most HP.
4. The proper mixture cable and routing is included in the insturctions.
5. Revised instructions with the new version.
6. New Flight Manual Suppliment.
7.
The current price for the STC is $200. The new update is $50 to current STC registrants.
My address is:
Thompson's Air
4375 Six B Road
Anderson, California 96007
530 357-5440

I thought you might like the update.
Randy

When you connect the engine to the new mount, a bit of juggling is necessary to get the Lord support parts to mate and it usually requires getting top or bottom mounts started, lift the engine again to get the other side to nest, and then tighten all. Not hard to do if you follow the sequence. Use new bolts and nuts and washers to attach the mount to the firewall.

If you observe an error or have suggestions, let me know.

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