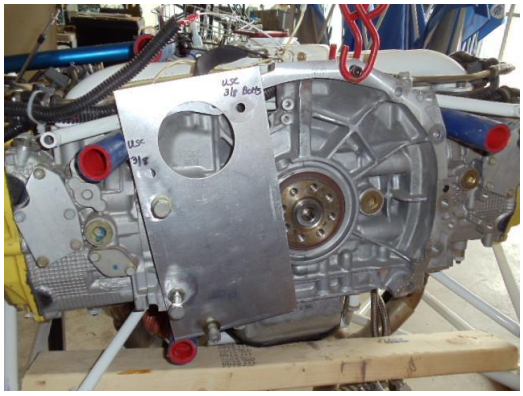
Instructions for Removing and replacing Gen X Gearbox with Auto PSRU's 200Z

Prior to your gear box arriving:

Using a strap or chain and an engine hoist to hold your engine up in the mount, remove your Gen X gear box, the engine mounting plate, and the flywheel from your engine.

There are some modifications needed to your engine mounting plate, which would be better served performed at a machine shop.

1) Mill out a 10 to 10.125 inch circle indexing from the center of the crankshaft. This will provide clearance for the diameter of the centrifugal clutch assembly. You may saw this hole out as well, as long as the hole is accurate from off of the centerline.
2) Mill out the location for the starter: Bolt the template for the starter cutout provided onto your engine mounting plate and use the template to mark the engine plate for the starter opening. Align the template using the lower holes along the bell housing in order to determine the location of the new starter mounting holes in your engine mounting plate. (We have no mounting plate for the engine in the photos) Countersink the mounting hole that will be covered by the starter for a countersunk bolt. It will replace the original mounting bolt for that location. You may saw this hole out as well, as long as the hole is accurate. Bolt the template to the bell housing and locate the new holes for the starter per the template.



If your mounting plate has been modified too many times in this area let us know as we can machine a new mounting plate with the starter location in it.
3) There is one bolt that will be under the starter and this hole needs to be countersunk for a flat head bolt. You can obtain one from a local bolt company.
4) The alignment dowels that protrude from the engine block through the engine mounting plate need to extend into the 200Z adapter plate alignment holes to align the gearbox. If your old installation didn't have these dowels, or are too short, contact us about replacement dowels.

Remove the upper starter mounting bolt if you do not want to install the starter on the mounting plate prior to installing the gearbox. You will not be able to slide the starter down the stud once the gearbox is installed.

What's Included:

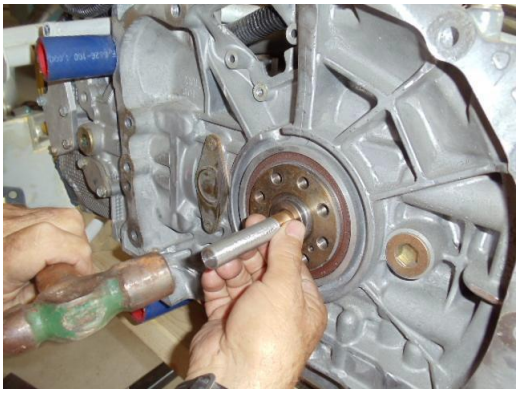
200Z Gearbox
Centrifugal clutch unit, temporarily assemble d for your benefit
8 bolts for flywheel
Replacement spacers for the mounting bolts
Pilot bushing and assembly tool

Unpack the box:

Remove the screws around the bottom of the box. Lift the box off of the base and reveal the contents.
Remove the smaller pieces mounted to the internal framework.
Remove the bolts securing the gear box and move it to a safe location.
Remove the bolts holding the pressure plate and flywheel to the bottom of the box.
Slide the clutch assembly out of the box.
Take note of the assembly of the centrifugal clutch assembly as you unpack the crate. It is sent to you preassembled so you can see how it goes together.

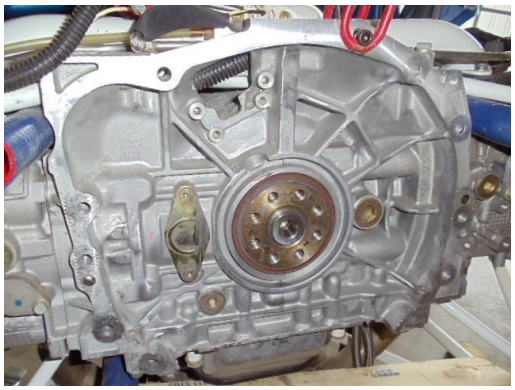
Install the crankshaft bushing:

Place the bronze crankshaft bushing on the installation tool as shown in the photo. Using a rubber mallet or a gentle touch with a hammer, tap the bushing into the end of the crankshaft until it bottoms out, or until the bushing is flush with the end of the crankshaft, whichever comes first. Once it is installed, apply a little bit of oil to the inside of the bushing to make installation of the remainder of the gearbox easier. You are now ready to begin installation of the centrifugal clutch assembly.



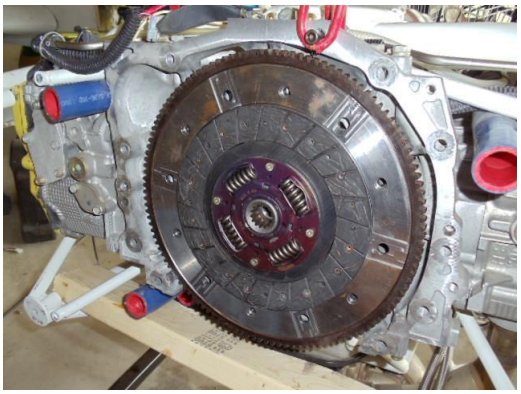
Install the Centrifugal Clutch Assembly:

Remove the six “fingers” on the clutch assembly by removing the six bolts from the rear of the flywheel. The "C" shaped weights can remain on the pressure plate. Test fit the flywheel using the bolts provided. Be sure that the bolts tighten down completely and that the flywheel is flat against the flange of the crankshaft. If it is not, it may be necessary to grind a few thousandths off the thread end of the bolt so that it does not bottom out before it is tight. In addition, be absolutely sure that the flywheel clears all of the webbing inside the bell housing. If the flywheel contacts any of the webbing use the included spacer behind the flywheel should correct any interference problems. If there is still any interference it may be necessary to dress the webbing with a grinder in some places in order for the flywheel to clear once it is bolted down flush to the end of the crankshaft. Grind out only the webbing where it is needed to create clearance. Structure other than webbing may contain oil galleys or part of the cooling jacket.



We found that the original builder of one of our engines had already ground out places inside the bell housing so all we had to do is just a bit more dressing and polishing. Once you are satisfied with the test fit, remove flywheel bolts, apply anti-seize and tighten just to hand tight. Alternately tighten them down with a socket wrench until all are snug, then torque to 35 ft lbs using the alternating method. Be absolutely positive that the flywheel is bolted down flat and tightly to the end of the crankshaft.

Use a screwdriver or other tool against the starter ring gear teeth to gently rotate the flywheel and that the flywheel is not making contact with any of the webbing inside the bell housing.



Position the clutch plate up in the flywheel. Either hold it in place or find something that will.

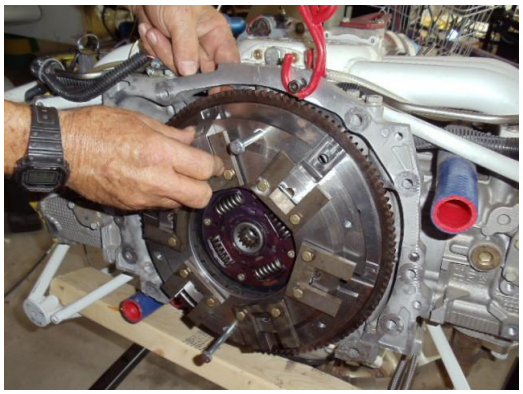
Install the pressure plate:

Be sure that all six of the small springs are still installed in the back side of the pressure plate before you bolt it onto the flywheel. These are important since they offload the clutch upon engine shut down and save wear on the unit.

Use 3-4 Phillips screwdrivers or use the 5⁄16 inch bolts from the shipping box to hold the pressure plate up aligned with the flywheel. The bolts will go through the holes between the fingers. Use the screwdrivers or bolts go through the center of the springs to temporarily hold everything aligned (including the clutch disc).

Installing the "fingers" on the clutch assembly:

Identify the spot on your bell housing that will allow access to bolt the "fingers" in place from the outside of the bell housing. This may be at the starter location, or there may be a cutout area on the upper right side that will allow access. Rotate the starter ring gear with a screwdriver until you get the first hole to the access spot. Using a 5"long - ¼" Allen wrench and using medium thread locker on the threads (you do not want these coming loose during flight) and coat the underside of the head with ARP anti-seize, bolt the first "finger" into the flywheel with the bolt provided through the back side of the flywheel and tighten the bolt between 35 and 40 ft-lb. After you have installed the first bolt, rotate 180 degrees and install the second one. Once you have installed the first finger, you may then use a crescent wrench or open end wrench along the sides of the finger to rotate the engine to the next location to complete the installation of all of the fingers.



Once you are positive that all bolts have thread locker applied and are snug, tighten all of the finger bolts with the 5" long - ¼" Allen wrench until the Allen wrench begins to flex. The pressure plate will not be pulled into its final position. You should now be able to slightly compress the pressure plate against the flywheel at this time.

If you did not oil the pilot bushing when it was installed, now would be a good time.

Install the gearbox onto your engine:

It is critical that your installation take place in the order listed herein. If you do anything out of order, you risk damage to your gearbox and/or engine due to improper alignment of the input shaft with the crankshaft.

Locate your engine mounting plate and bolt the gearbox onto the mounting plate into the new holes that you previously drilled.

Pick the gearbox up and insert the input shaft through the clutch plate and into the pilot bushing in the end of the crankshaft. Unless you are extremely lucky, the gear box will not initially seat flat against the engine mounting plate. Rotate the prop flange until the splines on the input shaft align with the clutch disk and the unit should slip in place. You may have to physically move the gearbox up and down or rotate it from side to side in order for the input shaft to seat all the way down into the end of the crankshaft. Be sure the gearbox seats flat against the engine mounting plate without forcing it.

Place one of the spacers between the mounting plate and the engine and insert one of the mounting bolts to hold everything in line. Do not tighten the mounting bolts until they are all installed and snugged up. Check the gearbox again to be sure that the prop flange turns and is not bound up. Finish putting the mounting bolts and spacers in place. Feel free to use a little adhesive to secure the spacers against the engine block to hold them in place for installation. Tighten bolts after insuring that the gear box will turn freely without binding on the engine.

Attach the motor plate back to the engine mount only after the gearbox is completely mounted to the engine.

Prop Installation:

If you are using an electric prop, the rear of your prop may be open and allow the oil from the gearbox to leak out. If this is the case, you will need an oil plug to install into the end of the prop shaft to seal off the oil passage in the prop shaft. If you find this is the situation, just contact Auto PSRUs and we will furnish this for you. Install your prop, governor for the hydraulic prop or prop brushes for the electric prop. You will need to fabricate a mounting bracket for your brush assembly on an electric prop. Install the included adapter that replaces the oil filter and plumbing lines to a remote oil filter location. The lines will run from the top opening of the oil pump to the in port on the remote filter and from the out ports of the remote filter to all the fittings on the case. The new hydraulic propeller governor will start working at 1900 propeller shaft RPM. After it breaks in it will start working at 1600 to 1700 propeller shaft RPM. It also requires 40 to 80 PSI oil pressure from the oil pump.

Lubrication:

Remove the oil filler plug from the top of the gear box and fill the gear box with 1.5 - 2 quarts of 75-110 or 75W-140 synthetic gear lubricant. Amsoil Severe Gear Lubricant and Royal Purple Maxgear are preferred, Lucas gear oil is also OK. These are the only synthetic lubricants tested and approved for use in your 200Z. The K&N HP-1003 is the only approved oil filter to use with your 200Z during the first 100 hours. After that a reusable stainless steel mesh filter like K&P Engineering's S9 filter can be used.
A 85-140 non-synthetic gear oil that is rated for top off- GL 5 or better may also be used, but foaming will happen if you don't use the recommended oil filter. Following your initial run up, be sure to check the gearbox oil to determine if it is yellowish and foamy. If this is happening, this means that the oil does not have enough anti-foaming agents in it. To solve this, you can obtain limited slip additive from your local auto parts store and add an ounce or two and run it until the oil begins to run clear. Occasionally we have found this to be the case if you don't use the recommended oil filter, so be sure and check. If the lube is foaming up, it will not properly lubricate or cool the gearbox, and it will not provide minimum pressures for a hydraulic constant speed propeller.
Pre-fill the oil filter before installing on the oil filter mount. This will assure priming of the pump and minimize air to purge out of the oil lines.
For hydraulic constant speed propellers, you may need to add some more oil after cycling the prop. Your gearbox was shipped to you with an oil level sight tube with full and low markings. Do not be tempted to modify this tubing. If the tubing gets damaged contact us for the proper replacement.
Once you have filled the gearbox with oil and you have cycled the prop (if it is a hydraulic prop) shut the engine off and wait for the oil to drain down to a static level. If the gearbox is over full, excessive oil will kick out through the vent filter in the top of the gearbox case. DO NOT PLUG THE VENT FILTER ON THE TOP OF THE GEARBOX CASE. You may attach a hose from the vent filter to an overflow bottle to catch extra oil and establish the proper oil level. An overflow bottle is recommended just to keep everything clean, not to mention smelling nicer.

Oil Pressure and Temperature:

The normal oil pressures should be about 70 to 80 psi at start up when the lubricant is cold. The pressure regulator in the system is set at 80 psi. As the lubricant warms up the pressure can drop to 40 to 45 psi. It should never go over the preset 80 psi. Again, these will vary a little depending on temperatures. A pressure gauge comes installed in the oil distribution manifold. A temperature sending unit is all installed in a 1⁄8" NPT threaded hole in the bottom of the case for this purpose. The minimum oil pressure in the gearbox is 20 psi warmed up to operating temperatures. This will assure proper bearing lubrication. Roller bearings rely on flow rate, not pressure. As the lubricant gets warmer and thinner it will flow better with less pressure and still properly lubricate. Hydraulic constant speed propellers and the propeller governor require a minimum of 40 psi for proper operations and control of the propeller pitch. Oil pressure below 1800 RPM on the propeller may be less than 40 psi.

Operating Temperature:

If the cowl is too tight and there is not enough fresh air flow into the front of the cowl, the gearbox temperature will run higher than preferred. Under normal circumstances, the gearbox temperature should not exceed 200 degrees F. At 200 degrees lubricants start to break down and mechanical damage will occur, so never allow the oil temperature to get this high. If cooling is an issue, there is not enough fresh air flow over the gearbox case. Add some ventilation to the area around the prop spinner on the front of the lower cowl and this will be resolved. This can be as simple as a couple of

one inch diameter holes, or blast tubes aimed at your 200Z, etc. at your discretion.

List of Never Does:

If you have made it this far without any problems or having to call us with any questions there are a few things you should never do to help your 200Z to serve you well for many years.

1. Never over rev your engine! Keep your engine rpm's below the maximum 6000 rpm. Your normal operating rpm's should be below 5500-5600 rpm's.
2. Never use cheap lubricants or oil filters! These could cause foam in the lubricant or reduce the circulation of lubricant though the gear box.
3. Never alter the lubrication system! The routing of hoses, orifice sizes, etc. have been carefully designed and tested to optimize the lubrication of all the components in the gear box. This includes the lubricant that circulates through the propeller governor. Contact us first if for some reason you need to run the engine and gear box without the propeller governor or want to switch to a fixed pitch propeller. We have a cover plate with the required oil galleys to replace the propeller governor and maintain all critical lubrication.
4. Never store your 200Z without preparing it for storage! Believe it or not, customers have left their brand new, just pulled out of the shipping crate, pride and joy just lying on the floor in the corner of the hangar. After lying around for a few years they didn't understand why they got signs of rust in the oil after their first test run. We have to ship all gear boxes drained of as much oil as possible after testing them as required by the EPA. This leaves them venerable to internal condensation due to temperature cycles and that will lead to rust on shafts and bearings. So fill it with oil, store it up off of the floor, and turn it over by hand once in a while.
5. Never use a propeller that weighs more than 70 pounds! This weight limit is set to prevent excessive gyroscopic loads on the propeller shaft and bearings. It is more than enough to cover all metal constant speed propellers sized for this horsepower range.

Overview

Your 200Z has been designed and built to be easy to fly with minimum maintenance and free of harmonic vibrations. While the instructions above may seem long or complicated, they really are not, and can be easily completed. If you have any questions just contact us. If your previous installation had cooling problems, etc. contact us for tips and advice to help correct fix those issues.
Refer to the Maintenance and Inspection Manual for details and tips on keeping your 200Z working like new.

We always encourage customer feedback and ideas for improvements. If you have any questions regarding the inspection, maintenance, and operation of your new 200Z gear box, please contact us. We will be glad to discuss the issues and help you arrive at a satisfactory solution.
Contact us at stuart@autopsrus.com or at (936) 827-5126.