Kohler – Tecumseh GenSet in LeSharo – Phaser
Removal, Disassemble, Reassemble, Overhaul, Test

C. Ray Dinwiddie
Olympia, WA
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Sandray@Olywa.net

I. Removal:

Because the genset has to be installed more or less perpendicular to keep the carburetor float valve in place, you might as well remove it perpendicular. To manage the perpendicular status, build a temporary holding plate to mount to the bottom of the generator.

A. Temporary holding plate .

Temporary holding plate is a ¾" in. x 14" square piece of plywood or chipboard. Draw a big x from corner to corner. Mark out on the X legs from the center 4 ¼ ". Cut a 3" hole dead center in the plywood/chipboard. Cut 4 each 2"x2" 4" long blocks and mount them with drywall screws (and glue if you want) to the board. The 2"x2"s should be mounted along the big X lines with the face of each at the line you earlier marked out 4 ¼" from the center. The opposing 2"x 2" blocks faces should be about 8 ½ " apart and represent the diameter of the generator lower case at the bosses for the long generator holding bolts. Cut 4 each 1 "x 2" blocks 4 ½ " long and notch the face of each of these blocks. Each notch should be about ¼ " wide and about ½ " deep. These blocks are the clamp blocks. Position the clamp blocks on top of the 2" x 2" blocks, but overhang center the clamp bocks to the center by about ½ " with the notch ends facing the center. Drill a 5/16" hole in the center of each clamp- 2x2 pair and go completely through the plywood/chipboard. Put a 3 ½ " x ¼ " bolt/nut/washer through the blocks. Position the ply/chip board on the bottom of the generator and place the notched clamp blocks over the ¼ " generator mounts bolts at the mounting bolt bosses. Tighten the clamp bolts/nuts to pinch the bosses to the board. Finally cut 8 blocks each 6" long from 4x4, 2x4 and 1x4 lumber. These 24 blocks are positioned under each of the 4 corners of the wood holding plate so that it can be lowered ¾ " at a time. Cut a 1x4 3ft. long as a lever and build a block pile as a fulcrum point to position the lever to take up the weight as you remove the corner holding blocks.

B. Remove the genset from the rig.

a. Remove the battery cable from the cabin battery.
b. Drain the oil from genset.
c. Disconnect the tailpipe at the muffler and loosen the tailpipe flex mount and rotate the tailpipe out of the way.
d. Open outside access door. Remove screws holding aux. Fuel filler to the plastic shroud. Remove the screws holding the shroud to the access door assemble. Remove the screws holding the access door assembly to the rig outer skin. Run a putty knife between the access door assembly mounting lip and the rig outer skin to break loose the silicone caulk holding the access door assembly to the rig out skin. Remove the access door assembly. You will probably find a couple of the mounting screws have stripped out of the aluminum out skin. Below I show how to quickly fix them.
e. Disconnect the exhaust pipe from the engine (no need to loosen the exhaust pipe/muffler clamp) and pull the exhaust pipe about ¾ " out of the engine and remove the muffler. The exhaust pipe screws are ¼ " hex female (Allen screw) style. Removing the muffler makes the removal of the 4 genset holding bolts/nuts a lot easier.
f. Disconnect fuel line and plug both ends.
g. Disconnect the ground cable from the rig frame.
h. Mount the wood holding plate (per above) to the bottom of the generator, and position the holding plate blocks under the wood holding plate corners.

i. Remove the 4 bolts/nuts that hold the genset mounting plate to the rig frame.
j. Use a 1x4 lever to aid in removing the blocks under the wood holding plate and carefully lower the genset to the floor.
k. Disconnect the battery cable from the starter solenoid.
l. Open the junction box on the front of the genset mounting plate and disconnect the wires coming from the house flex cable. It may be necessary to remove the junction box mounting screws to lift the box out of the way to get to the hidden ground wire in the back of the junction box. Disconnect the flex cable from the junction box.
m. Disconnect the choke wire and clamp at the carburetor.
n. Reach up to the top of the genset cavity in the rig at the front of the cavity and disconnect the wiring harness plug.
o. Use a floor jack to raise the rig about 12" and slide the genset out from under the rig.
p. Use duct tape and insulate the bitter end of the battery cable and tape it up out of the way so that you can drive the rig without the genset in place.
q. Clean off all the old caulk from the outside access door. If you have stripped screw holes, locate some thin galvanized sheet metal (I used roof gutter flashing) and cut a piece about the size of a large postage stamp. With a nail poke a starter hole about 3/16" back from the long edge. Push this patch under in between the outer aluminum outer skin and the foam insulation behind the outer skin. Center the new hole behind the stripped hole then remove the patch. Coat one both sides of the patch with contact cement and insert it back into the slot you earlier made. Make sure the new hole is centered behind the stripped out hole. Wait 20 minutes and screw into the new hole to make new threads. Put 3 or 4 small patches of silicone caulk on the outside access door and screw it into place. Later in final assembly you will remove the door to reinstall the genset. With the outside access door assembly out you save a couple of pounds of hide, blood and knuckles otherwise lost in removing and installing the genset.
r. Reconnect the house battery and lower the jack. Rig is now driveable without the genset in place.

II. Disassemble

Considering the time and expense of repairing the genset, it seemed to me to be penny wise and pound-foolish to not make sure the repaired unit ran perfectly before it is reinstalled. Therefore, I built a simple test stand to aid in working on the engine/genset and in running it before installation.

A: Test Stand Construction:
Cut two ½"or ¾" plywood 12" x 22" pieces. These boards are sides A and C of a hollow box you will build. Next cut two 2"x2" pieces of fir/pine 22" long. Use ring nails and glue and attach each of the 2"x2" to the long edge of each of the plywood pieces. These cleats are the top edges of sides A and C of the hollow box and they will face in to the opening where the engine will nest. Next cut four 2"x2" pieces 4" long and nail and glue these to the bottom corners of sides A and C as nail cleats for the bottoms of sides B and D. Cut 4 pieces of 1" x 4" fir/pine about 22" long. A pair of these 1"x4" are side B and the other pair are side D. With "C" clamps attach a 1"x4"x22" face down (you will nail through the 1x4 into the 2x2) to one upper side and outer end of side "A", clamp the other 1"x4"x22" to the other end upper side of side "A". Now attach side "C" upper edge at the ends to the ends of the 1"x4"x22" that you have attached to the upper edge of side "A". Before you glue and nail the 1"x4"x22" pieces to the 2"x2"x22" cleats at the top of sides "A" and "C" make sure that the inner faces of the 2" x2"x22" cleats of sides "A" and "C" are 16 " apart, and the inner edges of the 1"x4" sides "B" and "D" are 15" apart. When you are satisfied that you have a square hole 16" x 15", glue and nail the 1x4s of side "B" and "D" to side "A" and side "C". Finally, place each remaining 1"x4"x22"s (bottom of side "B" and "D") edge down at the floor and glue/nail each to the cleats at the bottom corners of sides "A" and "C". Last step is to cut 2 each 1½" angle iron 12" long. In each angle iron, drill two 3/8" holes on 8" centers on one leg of the angle and 4 each 3/16" holes on the other leg of the angle. Use 4 each 5/16 nuts and bolts to attach the genset mounting plate to the angles, then lift up the genset (with the angles attached) and set it down on

the 2”x2” cleats and place drywall screws through the angle iron 3/16 holes into the 2”x2” cleats. Now you can remove the genset by unbolting the mounting bolts and leaving the angles screwed to the test stand. Finally, when operating the engine while on the test stand to keep it from walking around from vibration cut 4 each 3” cubes of foam rubber to place under each corner of the stand.

B. Generator Removal/Disassemble/Reassemble/Installation

These instructions are designed to supplement instructions in the Kohler “RV Generator Service Manual” available from Mobility RV parts house. The manual costs about $17.

a. If you haven’t already drained the oil and removed the muffler, do it now.
b. With the genset right side up remove the carburetor. Remove the air cleaner; take out 2 long screws at the carburetor intake and one buried screw inside the plastic air cleaner case. Remove the fuel line at fuel pump and plug both ends. Remove 2 Torx headed screws at the joint of the intake manifold/engine block. Remove one mounting screw at the bottom of the carburetor. Remove the ¼” hex headed screw that attaches the governor arm to the governor shaft, leave the governor wires attached to the arm. Now the carburetor comes off. DO NOT rotate the carburetor on its side or upside down unless you plan on opening up the float chamber. The float valve is very delicate and becomes dislodged easily. Make a drawing or write yourself a note that explains how the governor wires, wire holes and spring were placed when you disassembled.
c. Remove the generator wires and wire cover from the genset main mounting plate.
d. Remove the genset operating wires and their wiring harness.
e. Turn the genset upside down and mount it in the test stand described above.
f. Remove 4 long ¼” bolts that hold the generator bottom cap to the stator. Whack the holding screw bosses a couple times to loosen the cap from the stator. It may not come off due to rust and debris in the outer race/cap joint. If you are worried (as I was) about busting the bosses get a 12” “T” bar puller at the rental place and pull it off. Don’t worry about the generator wires, you only need about ¾” slack to clear the bearing and turn the cap out of the way. Inside the cap where the bearing nests you will find a thin corrugated ring that binds the bearing race to the cap, take it out and don’t lose it, it has to go back.
g. Lift the stator (with dangling cap/wires) straight up and off the rotor.
h. Use a puller to remove the end bearing from the rotor.
i. Scrounge up a piece of hardwood (oak/walnut ??) about ¾”x4”x6”. Place the wood end grain against one of the vanes on the rotor and whack it good with a 3# or 4# hammer counter clockwise (right-hand threads – remove rotation), it is not tight (installed with anti-seize). Unscrew the rotor and remove. Mark the plastic fan to identify the side that faces the rotor and remove it (it will go on backwards if you are not careful).
j. With the engine still upside down, remove the power cable to the starter, and the ground cable to the case.
k. Block up the engine at the flywheel shroud to slightly suspend the test stand off the floor. Remove 4 each ¼” screws holding the engine case to the flex mounts on the genset main mounting plate. Lift off the test stand with the genset mounting plate attached.
l. To install reverse the above with the following variations.
m. Apply anti-seize to crankshaft threads that mate to the rotor. Use the wood block/hammer to tighten the rotor to the crankshaft.
n. Press on a new bearing at the end of the rotor (NAPA #6205-2RSJ or BCA #205FF). The bearing should be available from most auto parts houses for about $20.
o. Assemble a set of washers 1 ¼” OD and 3/8” ID. The washer stack should be 7/32” high +/- 1/32. Next get/build a small ¼” steel plate about 4” square and drill a 3/8” hole in the center. Finally, secure a 3/8” NC threaded shaft about 3” long with a long 3/8” coupling nut. This is the puller that will pull the generator bearing outer race into the lower case.
p. Place the stator over the rotor. Rotate the generator lower case/cap over the bearing (make sure you have installed the corrugated retainer into the bearing cavity). Thread the 3/8” threaded shaft through

the lower case and into the hole in the end of the rotor shaft. Place the washer stack over the treaded shaft and through the large hole in the lower case. Place the ¼"x 4" steel plate over the treaded shaft. Run the coupling nut down to pull the bearing into the case, but no further than permitted by the washer stack. Make sure to line up the mounting bolts before you press the bearing into the lower case.

q. Apply medium hold threadlocker to the long ¼" generator hold down bolts and tighten to 70 in. pounds.
r. Turn the engine right side up and set it down on the main mounting plate. Install the flex mounting bracket screws to the engine case with medium hold threadlocker. Attach starter and ground cables.
s. Feed the wires from the generator through the main mounting plate and attach generator wire cover to the main mounting plate.
t. Now you need to "flash the field". This restores the magnetism to the rotor that has been lost in its removal. Also sometimes if the generator has not been operated for a long time the rotor magnetism gets lost and as to be restored. To flash the field you have to build a very dangerous tool. Take a household extension cord and cut off the female end and strip the wires. Solder to each wire a standard spade connector. The generator wires in the wire cover coming from the bottom cap include 1 with a hole connector (the ground) one large wire (the output 12 GA.) and two smaller wires (field wires - 14 GA). The small wires go to the large capacitor in the junction box. Connect the extension cord spades to the small (field) wires (both should be separated from the capacitor and isolated from ground). With the spades connected to the field wires plug the extension cord into the 110 house voltage wall socket for ONLY a single second (remember say one thousand one = 1 second). This restores the lost magnetism to the rotor. After you have test ran the engine and established that you have generator output, cut the extension cord in pieces and through it away, so that the grand kids don't kill themselves.
u. Install the generator wires and the junction box cover.
v. See engine reassembly below for carburetor/governor setup steps.

C. Testing Generator stator and rotor.
Refer to Kohler manual. You will need a digital ohmmeter. Mine tested OK, and considering the built-in circuit breaker and the absence of any electrical connection (brushes) to the rotor I suspect that most will test OK.

III. Tecumseh Engine Disassemble/Reassemble.

The following steps are supplemental to the procedures in the "Tecumseh Technician's Handbook; 3 to 11 HP 4-Cycle L-Heads Engines" available from most Tecumseh dealers for about $8.

a. It is assumed that the oil is drained, the carburetor and muffler are off and the engine in removed from the genset main mounting plate.
b. Turn the engine upside down
c. Remove 6 or 7? ¼ in. screws that hold the upper and lower cases together.
d. Lift off the lower case from the crankshaft, you may have to tap it a bit but it will come off if the screws are out.
e. Do not disturb any parts in the upper case and continue to let it rest upside down.
f. Now you see the governor gear attached to the lower case.
g. The spool is held to the governor shaft by a small "c" snap ring, remove the snap ring but do not drop it you will never find it. Then remove the spool.
h. The governor gear (and the weights - a single unit) is held to the governor shaft by another "c" snap ring. Remove the snap ring and lift off the governor gear. Throw it away and install a new one.
i. Any Tecumseh dealer will have a governor gear in stock. They are a common failure. The cost is about $10.00.

j. When you reassemble make sure you install a new lower crankshaft seal. It is part of the gasket set sold by the dealer.
k. Finally, if you are real lucky when you get the cases apart you will see a clear and smooth lower crankshaft bearing surface and bearing bore in the lower case. I didn't and had to invent a rebuild system for the lower case (discussed below). The case with integral bearing is not available from Tecumseh. If the damaged area is no more than ½" at the upper end you can probable get away with it as is.
l. If you have to proceed further, the next steps are:
m. The large gear in the upper case is the cam gear, and at the end facing you (the bottom end) is the oil pump. The oil pump sits on a concentric on the cam and will go back together wrong if you do not mark it so you know how it came apart. Mark and remove the oil pump. It lifts right off.
n. Find the timing marks on the crank and cam gears and turn the crank until the marks line up. The crank is now at top dead center and the valve lifters (behind the cam gear) are loose. The cam can now be removed.
o. Get two large paper cups; mark one "exhaust" and the other "intake". Pull out the lifters and put them in the proper cup. The lifters and valves MUST go back in the same holes they came out of.
p. Turn the engine right side up. Drill a 2" hole in a 12" square piece of plywood and set the crankshaft through the hole as a temporary stand.
q. Remove the flywheel shroud.
r. Remove starter.
s. Remove the head.
t. Remove the Coil/Ignition module.
u. Remove flywheel nut. Use a chain or belt wrench to hold the flywheel (I had neither and substituted a 2" wide 2 ft. long ¼" steel bar as a pry bar on the flywheel vanes and got lucky and didn't break them). The nut torque is 50 ft. pounds. After the nut is off, place a long coupling nut with the correct threads for the crankshaft and thread it down to the flywheel and back it off 1 turn. Place a large screwdriver between the crankcase and the flywheel and pry up the flywheel, then whack the coupling nut good with a 3# or 4# hammer to loosen it. Remove the coupling nut and lift off the flywheel and remove the shaft key.
v. Remove the inner shroud.
w. Mark for installation the correct way, and remove the breather on the side of the engine.
x. Remove the valves. I used long needle-nose pliers as a valve compressor while holding the valve faces down with my thumb. Make sure you put the correct valve in the correct paper cup with the valve lifter.
y. Turn the engine upside down.
z. With a dull knife carefully carve out the accumulated carbon at the top of the cylinder wall. Be very careful to NOT remove any of the aluminum cylinder wall,
aa. Remove the rod cap nuts and the rod cap. Cut a ¾" cube of hardwood and place between the rod bearing and the crankshaft rod journal. Rotate the crankshaft to pop out the piston. Now the crankshaft lifts straight up and out.
bb. Reassemble is reverse of the above with the following hints:
cc. Do not attempt to reassemble without the Tecumseh manual, follow the torque limits.
dd. Install the coil/ignition module immediately before the flywheel and hold it to the back of the slotted holes and temporarily tighten the holding screws. After the flywheel is installed and torqued, rotate the flywheel so that its magnet faces the module, place a .012 feeler gauge between the flywheel and the module and loosen the module mounting screws. The magnet will draw the module down to the feeler gauge, now retighten the module mounting screws and remove the feeler gauge. You have just set the "air gap" for the engine.
ee. I used a large screw type hose clamp as a ring compressor.
ff. Get the gasket set from the dealer. This is the only way to buy the large narrow gasket between the upper and lower case.

gg. Install the upper and lower oil seals after the case is screwed together. Don't try to hammer them in place. Instead, place them over their bore and put a large 1" ID washer over them and pipe spacers up to the top of the crankshaft threads. Put a top washer over the spacers and nut on the treads and run it down to press the seals into the case.

hh. I substituted a double lipped lower crankshaft oil seal. Your auto parts house can get it for you. It is 1½" OD, 1" bore, and ¼" wide. Mine cost $5.

ii. Clean the mating surfaces of the upper and lower case with Acetone/Lacquer thinner. Coat each side with K&W Copper Coat gasket compound, if you use Permatex you will be sorry, it won't hold oil worth a damn. With the engine upside down, place the gasket on the upper case mating face and lower the lower case over the crankshaft into place. Be patient, you are lining up 2 dowels, the camshaft lower bearing and the oil pump ball. When they are all lined up the case can be pressed down by hand to the gasket.

jj. Apply high strength threadlocker to rod cap nuts. Apply medium strength threadlocker to the upper/lower case joint screws. Follow torque limits of the manual.

kk. See below for governor/carburetor setup steps.

IV. Repair of Catastrophic Failure (Broken Case)

The upper and lower cases are not available from Tecumseh. However, everything else is (Crank, Rod, Piston ((even oversize)), rings, etc.

a. If your case is busted, it can be welded back together. Even if you are missing a couple small pieces, you can cut and file close patches. Find the best TIG/Aluminum welder in town. If the cylinder wall is gouged severely, talk to the welder and or machinist about their ideas, they should have some, because you can get an oversize piston (.010") oversize. A couple small chunks busted out of the bottom of the cylinder wall skirts can probably be ignored.
b. With the engine disassembled as above and both halves of the case striped of all small parts and plugs, run the case halves and the pieces through Mother's dishwasher to remove every drop of oil. This makes the welder happy. Screw the halves together tightly with all the screws. You will minimize warpage with both halves tightly together. Ask the welder if installing the crankshaft and camshaft would also aid in limiting warpage. Do not separate the halves until they have cooled to room temperature.
c. Your welder will advise on how to hold the small pieces in place while he is welding. I have used plaster of paris on the backside of the weld to hold the parts in place for a light tack weld.
d. After welding you will have some warpage in the case halves. The crankshaft bearing surface warpage is corrected with a boring bar discussed below in restoring bottom crankshaft bearing. The case face warpage can be taken out with sandpaper.
e. To check case face warpage, find a 12' square piece of flat glass or mirror. Remove the case dowels, they will pull straight out. Lay each case half on the glass and poke around the edge with a .003" feeler gauge. If .003" goes between the case and the glass you must fix it, you can live with .002". Do this with both halves.
f. To remove any hills in the case surfaces, use spray glue to glue down to the glass a full sheet of 320 grit wet or dry auto finish sandpaper. Place the case half face down on the paper with a little light oil and rotate and grind it down by hand until flat (+/- .002"). If you think you have only a single hill to grind down, use contact cement and glue a couple narrow .005 brass shim stock to the case face opposite the hill. Grind down what you think is about half the hill and remove the shims and finish grinding until flat. Make sure both faces are flat when lightly screwed together (+/_ .002).

V. Restoring Lower Crankshaft Bearing (Near Catastrophic Failure).

Do to lousy engineering the dipstick sets the add mark too low. Moreover, because the dipstick is at the rear edge of the oil reservoir, the normal out of level conditions of our rigs, the oil full mark on the

dipstick tells the operator it is full when is it really not. As result, I think the most common problem with these engines is low oil, which results first in governor failure, which then permits the governor spring to race the engine with a wide open throttle plate (4500 – 5000 RPM). If the operator realizes that the engine is racing he turns it off and prevents rod failure and busted case/crankshaft. Otherwise he/she has a mess, the engine don't run very long at these speeds. At any rate any overspeed in low oil engine will damage the lower crankshaft bearing surface and its mating bearing surface in the lower case.

a. Assume the engine is disassembled as above and you have decided if the old crankshaft can be used. Mine was scoured good but the machinist ground it down by .010 dia and it took out 99% of the problem. If you can save your crankshaft by taking off .010 or less, use a double lip oil seal as a bottom oil seal and you should not have any problem. The seals are flexible and will reach in more than this and still seal.
b. Take the crankshaft and case halves to the best auto engine rebuilder in town and explain what you need. My machinist did the following.
c. Located several auto piston wrist pin bronze bushings that were a tad ID smaller than the crankshaft OD at the bearing surface.
d. Next he cut a plug gauge on his lathe about 3" long at the OD that he wanted to cut a new ID in the case bearing surface. The plug gauge was designed so that the new bore in the case would accept with a very tight press the OD of the wrist pin bushings.
e. He bolted the case halves together and ran a boring bar through the lower bearing to fit the plug gauge. He protected the upper bearing surface with a piece of shim stock.
f. If you have a welded case and want to true the upper and lower bearings, the same boring, wrist pin process should be applied to the upper bearing surface.
g. Then he drilled a series of 3/16" holes in the side of the wrist pin bushing to match the oil gallery on the side of the lower case bearing surface.
h. He then separated the case halves. Then he tightly pressed the side drilled long bushing into the upper end of the long bearing surface into the lower case. Next he turned the case over and pressed in a shorter bushing at the bottom of the bearing surface. Thus the lower bearing surface is totally comprised of wrist pin bushings.
i. Finally, he screwed the case halves back together and ran a smaller boring bar through the bushings in the lower case half to match the OD of the crankshaft. If he were also doing the upper bearing surface at this time he would open up the upper bushing to the proper OD of the upper crankshaft bearing.
j. When finished we have the old case halves with wrist bushings as bearing for the crankshaft that are better than the aluminum bearings in the original engine.
k. The machinist charged me $150, which is cheap when compared to the alternative.

VI. Carburetor and Governor setup.
Following assumes the engine is assembled and on the test stand.

a. Take off the fuel pump and remove the bottom filter cup and clean out the crap. Reinstall as it came off.
b. Remove the fuel float tank from the carburetor and clean it out. If you don't do a carburetor kit job reassemble carefully taking care to not dislodge the float valve. Check float height and adjust as necessary.
c. Install the carburetor.
d. Install the governor arm and wires/spring per your earlier drawing.
e. With the governor arm, spring and wires installed, loosen the small screw that holds the governor arm onto the shaft that penetrates the case. Next press lightly on the bottom of the arm, to rotate the shaft lightly counterclockwise as far as it will go (this sets the actuating arm on top of the governor spool), while at the same time press against the throttle plate to maximum open and then tighten down the small screw at the bottom of the governor arm.

f. Screw in the idle needle valve to closed and back it out 1¼ turns. No need to mess with the idle stop screw because this engine never idles, which is also the reason you do not adjust the idle needle valve, after it is set.
g. Screw in the main needle valve and back it out 1½ turns.
h. Connect the fuel line.
i. Do not install the choke lever mounting plate. It impedes governor adjustment. It is installed after all engine speed adjustments are made.
j. After test run below you install the air cleaner.

VII. Final Setup and prepare to test run the engine.

a. Fill engine oil. First time fill after disassembly is 1.3 quarts of 30-weight oil. Do not worry that the dipstick shows serious overfill, when you start the engine about 4 oz. will be forever hidden and never drained. Later fills after drain is 1 quart. If you have done machine work on the case/crankshaft fill with 20 weight oil and run for 10-20 minutes and drain it out and refill with 30 weight.
b. Run a wire from the hot side of the starter solenoid to the fuel pump wire. Cut and install a 6" piece of wire to the hot side of the starter solenoid strip and leave one end bare. This is the start switch. To start the engine, hold this wire to the small screw at the top of the starter solenoid. When the engine starts remove the wire from the solenoid. Install another wire from ground that will reach (but do not connect) the small spade connector that comes from the ignition module. Strip and leave one end bare. This is the kill switch and when the spade connector is grounded with this wire the engine stops.
c. Install muffler. I welded (brazed) the muffler to the exhaust pipe to remove one more rattle and seal another source of exhaust gases, you don't need the tail pipe to test run the engine.
d. Connect a 3' long fuel line to the input fuel line at the fuel pump.
e. Secure a tachometer. I got a Tiny Tach digital (forever battery) from the Briggs and Stratton web site for about $45. You just wrap a small wire from the tach around the spark plug wire and you have digital RPM.
f. Secure a gallon can and fill it with gas. Insert the fuel line extender hose into the can. It need not be above the carburetor; the fuel pump will lift the gas up.
g. Make sure you have some sort of vibration damper under each corner of the test stand, I used 3" cubes of foam rubber. The engine will walk about without dampers under the test stand.
h. Cut the male end off a household extension cord and strip the wire ends. Solder a female spade connector to one wire and fashion a hook on the other wire. Attach the connector to the circuit breaker open terminal and the hook wire to ground. This is the generator output test/load line. Insert the pins of a voltmeter to read 120 volts AC in the female end of the extension cord.
i. Build a governor spring adjusting tool. The ONLY way to adjust the speed on the engine is to bend the governor spring tang. The tool is needed to bend the tang. The governor spring tang is the small narrow piece of metal that is attached behind the rear carburetor mounting bolt. The other end of the tang has a small hole to attach the governor spring. The tool I made started with a piece of ¼" square steel bar about 10" long. I bent it into a "L" with a 3" and a 7" legs. At the end of the 7" leg I cut a slot about 3/8" deep and about 1/16" wide. The slot fits over the governor spring tang and the tool is twisted with the 3" leg to bend the tang, and thereby change the engine speed. The tang is bent counter clock wise to increase the speed and clockwise to slow the speed.

VIII. Test Run the Engine.

Assume the engine has been assembled and setup as above.

a. Connect a jumper cable from any car battery. You will hear the fuel pump clicking as it exhausts air in the lines and pump. If you notice raw gas coming out of the carburetor intake throat, you have a float valve problem that must be corrected before proceeding. When the fuel pump clicking slows, the air is out and the carburetor tank is full.
b. Your first goal is to start the engine and get it run in the 2500-3000 RPM range. To start the engine hold the choke plate closed with one hand and touch the starter wire to the starter solenoid. When it starts release the starter wire but keep the choke closed until the engine starts to choke down, then

release the choke, it is spring loaded open. Note the RPM and if not in the desired range, with a finger push the governor arm to increase or decease the speed and hold it where it will give the speed you are after while at the same time with the other hand bend the tang to change the spring tension to match the point that you are holding the governor arm. Now you have crudely set the governor.

c. Say a brief prayer and look at the voltmeter. It should read above 30 volts. If it doesn't make sure the circuit breaker is "ON" with the lever pushed toward you, away from the engine case. If it reads only about 4 – 8 volts you probably have lost the rotor magnetism and you must "flash the field" again a described above. If you still have no output after a second flashing you have a major adversity in the generator. I have no suggestions other than go to a Kohler dealer. Good luck, the Seattle WA Kohler dealer is not interested in small jobs and charges $150 an hour as a shop rate.
d. When you have stabilized the RPM in the 2500-3000 RPM range with generator output, let it run for 10 – 20 minutes and shut it down and drain the oil. Measure the drained oil with Mother's kitchen measuring cup. It should show 4 cups (1 quart) came out of the engine. Refill with 30 wt.
e. Devise a large electrical load for the generator and plug it into the output extension cord. Make sure you leave room for the voltmeter to report voltage when running with the load on line. I used two bathroom hair dryers. One set to fun high @ 1500 watts and the other to run low at 700 watts for a 2200 watt load.
f. Now restart the engine and set final RPM. Allow the engine to run unloaded for 5 – 10 minutes, then increase the speed by bending the governor tang (counterclockwise to increase and clockwise to decrease) to get about 3800 RPM, (Kohler recommended unloaded RPM) check the voltage, it should read about 130 volts. Turn on the load and watch the RPM, if it drops below 3500 RPM then you have the same problem I had. The governor spring is too strong. The loaded RPM is 3600 (Kohler recommended loaded RPM). This loaded RPM is ABSOLUTELY VITAL to make sure the output cycles are 60 CPS, and you don't fry any cycle sensitive appliances (microwave, TV, Radio, etc.). When I got to this step I found that a loaded RPM of 3600 became 4200 RPM when load was removed. I thought this was way too high for good engine life. I poked around in my junk boxes, and came up with a dozen or so small pull springs that I substituted for the Tecumseh stock spring. I fabricated (baling wire) new attaching wires about the same length as the combined length of the original spring and its attaching wire. I placed the revised governor spring and wire in place and bent the tang to see what the new spring supplied as RPM. Eventually, I found the prefect spring. Unloaded and loaded RPM hardly change from 3600. When load is added or subtracted the RPM momentarily falls, then overspeeds a bit then settles back to 3600. After running the engine under heavy load for a couple hours it still runs at 3590 RPM. My perfect spring is wire diameter .015", wound coil of ¼" diameter, coil length 1¼". Yours may be different because the spring is a balance between its pull and the opposing push of the governor spool inside the engine.
g. Adjust the main jet needle valve, by starting the engine and running it at 3600 RPM with a full (2200 watts) load for 10 minutes. Turn in the main jet adjuster (on the bottom of the fuel float bowl) in ¼ turn increments with 1 or 2 minutes between each turn until the RPM lowers (lean mixture), count the incremental turns from where you started. Next, return the needle valve to the point that you started from and back it out in ¼ turn increments until the RPM begins to drop (rich mixture). Count the increments. Add the increments from lean mixture and rich mixture and divide by 2 and run the needle vale screw back in by this value. This sets the main jet needle valve at the midpoint between lean and rich. Now you may need to readjust the governor tang to get the necessary 3600 RPM at load. Mine wound up were I started, 1½ turns out from closed.
h. After you have made complete reinstall of the genset in the rig, park it more or less level, start the genset and run it for an hour. Drain the oil and replace the plug. Add one pint (2 cups with Mother's kitchen measure) and mark the dipstick with a file edge as a new "Add" level. Add anther pint and mark the dipstick for a new "Full" level.

IX. Pictures

Attached are to JPG files that show the temporary holding plate and the test stand. The files are named holdplat.jpg and teststnd.jpd. The pictures are black and white to conserve download time.

a. Holdplat.jpg

This file contains two pictures of the holding plate. The upper picture views from the floor at the left rear of the rig toward the front it. I shows the back part of the holding plate as it is mounting on the bottom of the genset. The clamp blocks are on top of the bosses for the long generator holding bolts and you can see how the clamp blocks pinch the bosses to the chipboard holding plate. Not shown are the block piles under each corner to hold the weight of the genset as it is lowered to the floor.

The lower picture shows the holding plate resting on the floor. Note the clamp block removed from its pinching bolt at about 4:30 on a clock face. See the opposing clamp block at 9:30 with the clamp block in the final pinch position. The other clamp blocks are turned about 90 degrees from final to show that they are movable.

One final thought about removing the genset. That big bearing boss at the bottom sure looks inviting for a floor jack as a removal tool. Unless you have two healthy strong men to help you take it out AND put it back don't fall for the temptation. The boss is not at the center of gravity and as soon as the genset clears the sides of its main mounting plate it will fall over.

b. Teststnd.jpg

This file contains two pictures of the test stand. The upper picture shows the test stand from a low angle. The mounting angle irons can be seen as well as the wooden parts. The dark stain on the rear angle iron is a nothing. I must have earlier used the stock (old bed frame) for some welding support. The lower picture is from a higher view and a little more distant to show a more full view of the test stand. Here you can see that the test stand is open on the bottom, two sides (B and D) are also mainly open except for the bottom 1"x4"s. You will notice that the upper long cleats on the chipboard are 2"x4" lumber as opposed to the 2"x2" lumber I discuss in the narrative, After I build the stand I realized that the smaller lumber would be as good, but lighter and a little less costly. Also, you might see that I used drywall screws rather than ring nails as discussed in the narrative, again post construction evaluation changed my mind, ring nails and glue are just as good as drywall screws and glue, but faster to install and cheaper.