

## CHANGING THE ENGINE IN A GMC MOTORHOME

### Preface to engine removal

Taking the engine out by lifting and moving to the center door was, I believe, pioneered by Darrel Winterfeldt sometime in the late '80s and has become the method of choice.

Disclaimer for the author and for GMC Western States: The material presented below is based on my personal experience and the personal experience of other club members. It is our viewpoint and does not represent authorized data pertaining to the GMC Motorhome. It is the responsibility of the reader to make their own judgment as to the validity of this material in relation to any repairs and/or modifications they do to their own vehicles.

Safety: Because of engine weight, some of the procedure is inherently dangerous. Those attempting to do this must use extraordinary care to prevent accidents. During assembly, it is very important to follow the procedures as given in the GMC Maintenance Manual X7525. Use an accurate torque wrench where it calls for specific torque specifications. Any personal injury accident which can be traced back to your workmanship may result in criminal and/or civil penalties.

The object is to take out the engine through the engine hatch opening using an overhead hoist with trolley. To work under the coach it must be raised somewhat and, for obvious safety reasons, securely supported. I prefer stout wood blocks to jacks. After raising the coach there is work under the coach and work through the hatch opening.

The sequence given below favors removing components from under the coach first and finishing up on top. I favor doing the bottom end first, draining oil and coolant fairly late in the sequence so that I don't have to work in or around messy spills. The main thing is that all engine attachments are removed, the engine unbolted from the transmission/final drive/front engine mount and the engine lifted out.

A hint that will make assembly easier later is to try to keep bolts, nuts and washers organized. That means: If you have a replacement engine, transfer the bolts to the new one as they come out. Or, you can put them in "baggies" and label them with a felt pen. At any rate, don't throw them all into a coffee can, you will spend a lot of time trying to figure out which ones have the correct hardness, are too long or too short.

You will need a trolley arrangement to lift the engine up through the engine hatch and then move it to the coach side door. Many designs are available.

Before proceeding, you should also consider having an "engine cradle" or temporary holder for the engine to use during the transfer of the engine from overhead trolley to a "cherry picker." Supporting a heavy engine on the oil pan may not a good practice.

## ENGINE REMOVAL PROCEDURE

Remove or protect interior furniture and carpeting that will interfere or be damaged.

Raise rear wheels and let down bogies on 10" high blocks of wood. [a 6x10 about 14" long is OK]

Disconnect engine battery.

Loosen wheel nuts.

Raise front end and support frame. 15" where the body frame joins the curved front frame section gives me adequate work space underneath. [I use blocks of wood; a 6x12 plus a 4x4 and a piece of 1x4, all about 14" long].

Remove front wheels and fenders.

At this time I unbolt and support the right side output shaft and remove the output shaft bearing bracket.

Note: Some do not remove the right output shaft and associated drive line, they simply disconnect the bearing plate from the bottom of the engine. If you do leave them connected you will need to support this loose wobbly drive line/output shaft assembly to prevent damage to the final drive/output shaft.

Remove spark plug wires, distributor and spark plugs. Air cleaner too [I cover the carb.].

Remove exhaust manifolds and preheat shroud [or headers]. Tie up or support mufflers if needed. [It may be necessary to "tilt out" the transmission dip stick tube to remove the exhaust manifold on the driver's side. Remove the dip stick bolt and carefully "rotate" the tube. The "O" ring will keep the transmission fluid from leaking out.]

Take out the starter motor. You may need to unplug the kick down wire to the transmission and disconnect the transmission vacuum modulator line.

Remove lower transmission converter cover plate and disconnect the Flexplate from the torque converter.

Drain engine oil and remove filter.

Unbolt engine oil filter base assembly [I drain and put the whole filter base assembly into a "baggie" and tie it to minimize oil mess] and tie back out of the way. [I also cover engine oil holes with a plate and cork gasket]

Drain coolant and disconnect lower radiator hose at the water pump. Remove block drains [2] and, after draining, replace plugs.

Remove carburetor together with all hoses and fittings Tie back throttle and cruise control cables. [I label all wires and hoses that aren't obvious.]

Disconnect thermostat end of the upper radiator hose, remove thermostat housing and thermostat.

Disconnect and tie back heater and water heater preheat hoses.

Early coaches with a flexible fan shroud will need upper and lower supports removed. [I now use an after market fiberglass shroud which eliminates these four supports]

Remove the fan belts, fan clutch with fan, fan pulley and crank pulley.

Remove power steering pump and mtg. brackets [support the pump].

Disconnect and remove alternator and brackets.

Remove, support and tie back air conditioner compressor with hoses. [I use a small makeshift shelf to hold the compressor making lifting easier.] There is no need to let the system down to air. Remove brackets.

Disconnect and tie back all wires and anything else that could interfere with lifting the engine. [Transmission "kick down" wires are usually routed over the front of the engine. These may need to be cut and later spliced.]

Remove water pump. [Make a diagram to help replace the bolts and studs later on]

Remove the stud [with the "long" hex section] that holds the ignition time mark scale and the front engine support. Don't lose this special stud because the alignment of the power steering pump depends on the height of the hex section. Temporarily replace the stud with an ordinary bolt.

Rig engine lifting apparatus and whatever you will be using on the engine. [I use a home made lifter that bolts onto the intake manifold in place of the carburetor. It is T shaped, the vertical part, with lift hole/s, welded to a base plate.]

Leaving the front engine mount bolted to the front engine foot, remove only the two lower bolts [thru frame cross member]. Remove the engine mount from the foot after the engine is out.

Lift engine slightly [to take the weight off the front engine mount] and support the final drive or the final drive end of the transmission. [Again, I prefer wood blocks because, in the process of dropping the engine into place, a jack could be dislodged.] [I happen to have a Ragussa aluminum transmission pan and I simply place some wood under it closest to the final drive. This also leaves room for a small bottle jack to be placed under the final drive if it becomes

necessary to use one.] Remove final drive to engine support bracket bolts [2] leaving the bracket [with the long bolt] connected to the final drive.

Remove transmission to engine bolts [6].

At this point the engine should be disconnected and ready to take out.

Carefully apply some lift, and, with a small pry bar or screwdriver, move engine forward [at least an inch] to release the engine from the transmission.

When all is clear, lift engine [watch the Flexplate], move it down to the door, transfer it to the "cradle," pick it up with the "cherry picker" and move it out. [Careful with the lower half of the dipstick tube if it still stuck in the engine.]

### ENGINE INSTALLATION PROCEDURE

Good time to "prep" the engine. Make sure that studs are in the correct location, Add Flexplate, choke heater tube, etc. Check to see that block coolant drain plugs are in and tight. Clean gasket areas. Lay out parts. Find missing bolts.... Replace hoses.

Check to make sure that the special stud [that holds the timing scale [for time marks] and holds the front engine mount foot to the engine] has been reinstalled. This stud, mentioned earlier during removal, has the correct "hex" height necessary to have the power steering pump line up properly.

Install the front engine mount to the cross member but leave these lower bolts loose so that the mount can still be moved.

Pre-position engine crankshaft so that Flexplate holes and converter lugs will line up, otherwise the balance weights on the Flex plate may hit the lugs on the converter and make mating of the engine and torque converter difficult. It may bend the Flexplate too.

Install one or two guide studs into the engine block [on top is fine] to help line up engine and transmission during the mating process.

Carefully lower engine into position, while watching alignment of engine and final drive to engine bracket. Move engine rearward [on guide studs] to engage engine to transmission pilots. Start and loosely install engine to transmission bolts [6]. Before pulling the engine tightly to the transmission check, Flexplate to converter alignment. The converter should be free to rotate, subject to balance weights hitting toque converter lugs. Hint: Watching the space between the engine and transmission gives an indication of what movement is needed to engage the pilots. For instance: if the gap on top is tight, it means that the front of the engine is high or that the final drive is too low. If the final drive is low [while the front engine foot is on the engine mount], raise the final drive with a jack.

Start final drive to engine bracket bolts [you may need to juggle things somewhat]. Go back and torque transmission to engine bolts [6] 30 ft lbs. [Don't forget the vacuum modulator tube clamp that goes under one of these bolts]. At this time, check to see that the front engine foot to engine mount is roughly in alignment before lowering the engine.

Tighten but do not torque final drive to engine bracket bolts [because one of the power steering brackets fits under the front bolt]. Remove support from under transmission & final drive.

With a little engine lift to be able to slide the engine foot on the front engine mount, line up and install two upper bolts for the front engine mount. Hint: These bolts are short enough so that you can install them "head end down" which makes it easier to start the nut on top. Line up the bolt holes on the power steering pump side first, it is visible. Because the crankcase pan is so close to the nut on the air conditioner pump side, I slightly chamfer the nut for more clearance and put the lock washer under the head. With all in alignment, torque all 4 bolts.

Engine lifter may now be removed.

Install 3 flywheel to converter bolts. [I use 45 ft lbs. + Loctite]

Install lower transmission converter cover plate.

Install starter motor and wires and reconnect the "kick down" switch wire. Connect the engine battery ground wire to the block.

Install right side output shaft bearing bracket and drive line if removed. Make certain that final drive output shaft alignment is pretty much centered and torque the bolt and stud. [The stud, usually the front one, holds a cable clamp that keeps the starter battery cable away from the final drive output flange.

Install engine oil lines and filter assembly with a new gasket. I use Felpro or Cinnabar fiber gaskets that are .016" thick. I use a thin coat of Permatex Aviation Form a Gasket Sealant Liquid [product # 80019] on all metal and gasket surfaces and allow several hours of drying time before mating. Torque to specifications and install oil filter. Add oil line supports. [Warning: Felpro engine overhaul kits contain a couple of gaskets that have the same bolt hole design. Only one of these is correct. The wrong one leaks!]

Connect the upper engine oil dip stick tube to the lower tube and, when aligned, carefully tap the lower tube into the engine with a suitable tool and hammer.

Install and connect exhaust manifolds [and preheat shroud] or header pipes to mufflers. If transmission dip stick was moved, straighten it up and bolt it back on.

Install water pump leaving off hoses. Hint: Use two studs to hold the gasket and guide the pump.

Install air conditioner compressor. Hint: Use a stud on the lower bolt hole to guide the front support casting. Torque these bolts. Install the rear casting loosely and torque after the compressor is in position.

Install alternator bracket [alternator can be installed after power steering pump is in place].

Install power steering pump and mtg. brackets. Hint: Assemble the whole unit before tightening up the bolts because you need to be able to juggle things around. Don't forget to torque the final drive to engine bracket bolts [55 ft. lbs]. On the rear bolt use a "crow foot." of adequate strength.

Install the alternator and hook it up.

Install the crank fan pulley, fan belt pulley, fan clutch and fan belts. Check for reasonable pulley alignment, especially the power steering and alternator.

Install the upper and lower radiator hoses, heater hoses, thermostat with thermostat housing, TVS, oil pressure and temperature sending units.

Add coolant. Check for leaks.

Install the oil fill line and add engine oil [your choice]. Using a reversible low speed high torque electric drill motor and a 5/16" long reach deep socket with extension, turn the oil pump CCW thru the distributor mounting hole to prime the oil galleys and to check for pressure oil leaks. Caution: Don't drop anything into the distributor hole, otherwise you may need to take the engine out again to retrieve it. Hint: I use duct tape to secure the 5/16" socket to the drill driver shaft to reduce the risk of losing it inside the engine.

Install carburetor, manifold vacuum fittings and hoses, TVS and PCV valves, and throttle, and cruise control cables.

Reconnect all wires. If the "kick down" lines [over the front of the engine] were cut, splice them.

Determine #1 cylinder TDC and install distributor. Hint: Visually lining up the reluctor teeth puts the ignition in a 'slightly retarded' position. Install spark plugs, cap and plug wires.

Add air cleaner and give the whole job a good visual inspection.

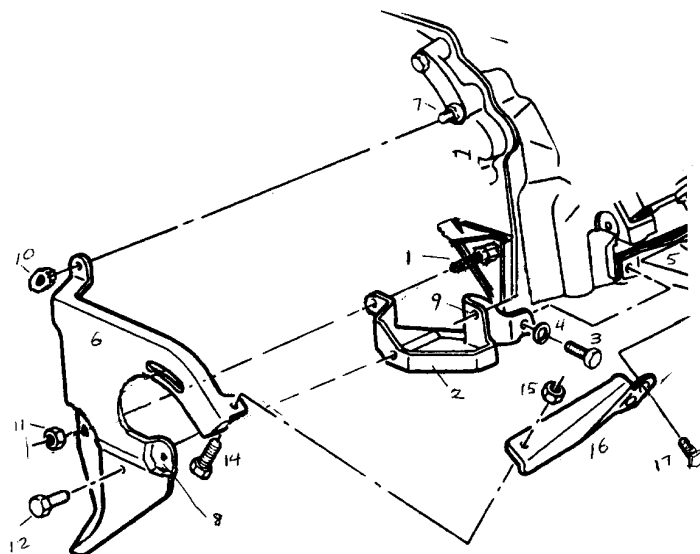
Install front wheels. Lower front end and torque wheel nuts. Remove rear blocks and re-level the coach after the engine battery is back in service.

Reconnect batteries. Start engine and time the ignition according to specifications with a timing light. Avoid extended idle while doing this.

Initial run in for a new motor. Watch coolant temperature closely for signs of overheating. No extended idle. 3,000 rpm is OK in short bursts with the engine running easy. No high cylinder pressures [engine ping & WOT [steep hills]]. Vary engine speed during the first 1,000 miles. "Normal" driving after about 2,000 miles.

Change engine oil and filter after a few hundred miles [ I aim for 200 miles]. Optional: Cut apart the oil cleaner and check for abnormal particulates.

### Assembly of Power Steering Brackets with Pump



Torque [50 Ft. LBS] stud [1] in place [stud 1 has a built-in 0.575" high nut section] [it holds the timing scale and front engine support bracket to the front of the engine].

For all the following operations tighten fasteners snug but not tight to allow for movement during alignment of parts.

Hang bracket [2] onto stud [1] and bolt bracket to Final Drive Support bracket [5] on with bolt [3] with lockwasher [4]. Bolt [3] is 1.75" [and rear bolt for [5] is 1.25"]

Hang bracket [6] [with Power Steering Pump attached to front pivot point [8] ] onto stud [1], and stud [7], threading the Power Steering Pump rear support bolt into pivot [9] on bracket [2].

Hold with nuts [10] and [11]. Install nut to hold rear pivot of Power Steering Pump.

Insert bolt [12] holding brackets [2] and [6] together.

*Better yet: insert a bolt [12] into rear of bracket [2] and use a nut and lockwasher on the front of bracket [6]. Devise a way to hold the head of the bolt inside bracket [2].*

With bolts and nuts [14] [15] and [17] connect bracket [16] to bracket [6] and to the front bolt of the exhaust manifold.

Check alignment of pulleys and tighten fittings.