

ENGINE ASSEMBLY AND SEALER TIPS

Thanks for purchasing a rebuild kit from Mastertech. Here are some tips to help you with your rebuild.

Use care in disassembly of your motor. Many components are die cast aluminum and various plastic composition and require extra care in handling. Always remove exhaust and cylinder head covers, if equipped, and ensure there are no blockages or missing water deflectors. Replace the deflectors if deteriorated. Alignment pins on OMC-Johnson-Evinrude engines are tapered, and should always be driven out towards the front (crankcase cover side) of the block.

You are provided 3 different sealing compounds in your rebuild kit. The red "GEL-SEAL" is an anerobic sealer used for the crankcase flanges. Be sure you have removed all traces of the old sealer. I always lightly face across this flange, both halves, with a mill file to remove any nicks or high spots. Apply from tube sparingly, and, with your fingertip, dab it around until you have an even thin film on the entire block mating surface. You need apply it to only 1 side, and stay ½" away from the center main bearings. On Force motors run a thin bead around the top main ball bearing. You may use this on the main bearing and flange bolts as well to keep them from loosening during use.

LOCTITE 271 is a high strength threadlocker, similar to the Gel Seal, but in a liquid form. I use it on top, bottom main bearing cap attach screws, on the periphery of oil seals,

The "GS1-2" gasket sealing compound, brush-in-cap, is a water-resistant soy based sealer that will ease future removal of fasteners and allow you to get an even torque on all the bolts. I brush it on the threads of all the rest of the powerhead bolts (even the head bolts) and under the head bolt heads. Use it on all cover gaskets that will be installed in areas where water flows such as cylinder head covers, exhaust plates and covers as well as port covers, etc. Intake manifold, air silencer and carb flange gaskets should be installed dry. Coat the outer periphery of the head gasket but not the area around the cylinder itself. Most base gaskets are self-sealing and require no sealer.

On Force motors, THREE BOND 1104 (not included, available at parts stores) can be used between the powerhead adapter and the exhaust housing. Remaining material can be used wherever else you might have need for a good sealer, but never use this rubberized compound, or any silicone, on any fuel related joints or flanges as it will swell and break off, plugging your lines and jets!!

Pistons, connecting rods, rod bearings, and retainers are wearing parts and seat with operation of the engine. Because of this, it is essential to maintain their original positions at reassembly. Using a scribe, or indelible ink marker, mark each connecting rod, cap and bearing component when they are removed to ensure correct mating upon reassembly. On most newer motors the connecting rod caps and center main races are what is called "break fit"; that is, the part is hardened, finish ground and then actually broken in half in a fixture. As a result these are all matched assemblies and must never be mixed up. If you mixed 'em, look carefully at the color and machine marks, this will generally allow you to sort them back out. I use momma's rejected muffin tins, marked as to cylinder #, to store these parts

Before any component inspection can begin, all internal components should be rinsed with solvent and lightly recoated with a fine oil such as "OMC" 6 in 1 or LPS 2. Examine your cylinder bores carefully for scuffing, wear and taper by measuring with an

inside micrometer for out of round, oversize or tapered condition. In my opinion you should take the block to a qualified machinist for measurement and boring if necessary. Oversize pistons are manufactured to suit given oversize bores and are not required for fitting as commonly done with automotive rebuilds.

Cylinder bores should be honed with a 280 grit stone in a crosshatch pattern and finished with a ball hone. This looks like a bottle brush and will help break the sharp edges of ports as well as getting areas that a parallel stone hone may miss on an un-bored block. Remember, the function of the honing is to provide roughness where oil will be retained for lubrication. I always use a steel scraper to put about a .020" 30 degree chamfer on the top of the cylinder to ease ring installation. Always wash the honed block thoroughly with soap and water (I use OIL-EATER, available at most parts stores, followed by a dishwashing detergent second scrubbing) to remove all traces of honing residue. Left-over carborundum and iron from honing can ruin an otherwise perfect rebuild.

It is very important to notice that connecting rods with oil holes have a top and bottom. All rods with a diagonal oil hole will always face the flywheel. When installing wrist pin bearings the washers with a raised inner lip are always installed flat side out. Installing wrist pin circlips can be an exasperating job. Manufacturers supply a special tool for this, but you can get by as follows. Insert the circlip diagonally in the groove with the gap facing away from the notch in the piston. Now while pressing down on the opposite (gap) side with a narrow screwdriver or flat tool, place it in the notch in the piston and "roll" it over the circlip; it will slide down the blade and into the groove.

Piston installation in the block is pretty straightforward. Be sure to note the top, port and starboard piston designation on loop charged motors. If you put looper pistons in upside down or backwards your motor will run but not well and damage may occur. The older "deflector" pistons always go with the sharp side facing the intake. Pay particular attention to ring orientation. Most modern piston ring configurations are keystone pressure back type. That is; they are tapered from outside to inside. The second ring in many cases is rectangular. Both rings on Wiseco pistons are this type and the side marked "top" faces up towards the combustion chamber. You can use an automotive ring compressor or just work them in with your fingernails or a plastic tool. Be sure to get them located such that the end gap is over the little pin in the ring groove. Liberally coat these components with outboard lubricant as you go. Use *petroleum based oil*, not synthetic.

Installation of the center mains on the crank is no problem, just be sure the 2 halves match and install the little retaining wire clip. Lower main ball bearings on many motors are retained with a snap ring. Be sure to reinstall this ring with the "sharp" side out. On OMC "V" motors you can loosely install the heads to keep the pistons from dropping out. Move the pistons to a position such that you can hold the rods to the side with a rubber band. Now carefully lower the crankshaft into place being sure to rotate the center mains to align and drop onto the tool pins in the block.

Orient all crankcase seal rings, if equipped, with the gaps facing up. Now rotate the crank and orient the rods such that you can insert the bearings and retainers with Vaseline into the rod and gently pull the rod up to contact the crankshaft. "Break fit" rods should have the caps very lightly tightened while, with a pencil lead or your fingernail, running across the beveled edges of the rod to be sure they are lined up properly. *Never* tighten the bolts up until they line up, or the rod is toast. 3 out of 4 corners perfect is ok. If they won't line up, replace the rod. Bombardier supplies Evrinrude-Johnson dealers with an expensive (\$300.00!!) Rod cap alignment tool – if you're unsure about this alignment process perhaps your local dealer will loan or rent you this tool. Be sure to liberally oil the rod cap and bolts before you put it together.

Now you're ready to reassemble the crankcase to the block; re-read the gel seal procedure at the start of these tips for installation. Be sure the flanges are clean and perfectly dry, I wipe 'em down last with a non-linty rag with lacquer thinner. Always torque covers from the center out and larger main bearings 1st.

When you have the basic powerhead together, you can give it a washdown with some solvent and a nice coat of black or matching motor color to spiff it up as well as helping prevent corrosion. Reinstall the powerhead to midsection bolts with a liberal coat of gasket sealing compound (Gel Seal) to prevent corrosion. Now that you have redone the powerhead, please reflect on what you found that was bad and determine the cause. I would advise checking thermostats, water pump, carburetor jets and motor timing before you have the same problem twice. Please look on the website at: <https://www.maxrules.com/fixbreakin.php> for the proper break in procedures to avoid a meltdown of your fresh rebuild!

Thanks again, good luck and enjoy!!

ADDENDUMS - TORQUE SPECS IN STAGES:

Force

Conn rod bolts: 170 inch pounds

Main bearing bolts: 270 inch pounds, apply Gel Seal

Flywheel nut: 90 foot pounds, Gasket Sealer on threads!

Cylinder head: 225 inch pounds, Gasket Sealer on threads!

The rest, standard torque values.

"OMC" 9.9-15 HP

Flywheel nut: 45-50 ft-lbs, Gasket Sealer on threads

Cylinder head bolts: 216 – 240 inch lbs (18-20 ft lbs), Gasket Sealer on threads!

Connecting rod screws: 60-70 inch lbs oil threads

Main bearing screws: 144-168 inch lbs Gel Seal on threads

Exh cover screws 95-130 inch lbs, Gasket Sealer on threads!

Remaining ¼-20 screws 60-84 inch lbs

"OMC" torque specs, 25 thru V6 crossflow

Flywheel torque: 100-105 ft lbs

Head and main bearing large bolts, torque 216-240 inch pounds Gasket Sealer on head bolt threads!

Small ¼-20 cc flange bolts 60-84 (nominally 70, standard) Inch pounds.

Same for exhaust, port covers etc. with ¼-20 screws.

Rod bolts 30-32 ft lbs 360-384 inch pounds

V4 upper and lower crankcase head screws, 96-120 inch pounds, apply Gel Seal

"OMC torque specs 60 degree Looper V4, V6

Flywheel flange bolts: 23 - 25 ft lbs

Cylinder heads: 20 - 22 ft lbs apply tiny bead silicone around water passages, Gasket Sealer on threads!

Main bearings 26 – 30 ft lbs apply Gel Seal

Crankcase flange bolts 40 - 50 inch lbs

Rod bolts 30 - 32 ft lbs 360-384 inch pounds

6] large block-to-midsection bolts: 25 – 35 ft lbs apply Gasket Sealer

5] small block-to-midsection screws: 60 – 84 inch pounds

Upper mount retainer to block: 42 – 50 ft lbs

Important - steering arm to upper mount: 65 – 70 ft lbs

Mercury 40-50-60 3 cylinder Looper, 2.992 bore Mercury 40-50-60 3 cylinder

Flywheel nut torque: 100 foot pounds

Connecting rod bolts: 120 inch pounds + ¼ turn

Block crankcase M8 x 30 bolts: 18 foot pounds

Stator screws, CDM module to plate: 60 inch pounds