Measuring and adjusting main bearing and rod bearing clearances

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The recommended oil clearance for Model A Ford main and rod bearings is .001", (one thousandth of an inch). Through normal use of the car, the soft babbitt bearings slowly wear away and the clearance widens. If unattended, the clearance can become so wide that improper lubrication and hammering will occur. Serious damage to the crankshaft is the result.

Adjusting the clearance is fairly simple. In addition to removing everything that was necessary just to get to the bearings, I removed my exhaust and intake manifolds. The extra room to work was useful. If possible, having a helper will be handy, but you can do it by yourself.

A fair complement of normal hand tools is necessary. If you have a 1/2" and a 3/8" drive socket set, a combination box end/open end wrench set, and some screwdrivers and pliers, then you have nearly all that's needed. A zero-to-one inch micrometer will be handy for measuring shim thickness. You may need a 21/32" socket of the 1/2" drive variety. That's what I needed for my rod cap nuts. I bought one for $2.40. You may also want a torque wrench. Before you start to work, try to have the following on hand:

- a tube of "Lubriplate" to pre-lube the bearings
- two strips of .001" to .003" Plastigage
- a tube of #2 Permatex gasket sealant
- 14 cotter pins
- an oil pan gasket set (when you get this, take the rope piece out of the package and begin soaking it in oil, as much as a week is good)
- a valve cover gasket
- an oil return pipe gasket set
- a manifold gasket
- a variety of main bearing and rod bearing shims (someone who has done this before may have some left over)

Disassembly Steps

1. Park car in work area, apply handbrake and block wheels, put transmission in neutral.

2. Disconnect battery from the electrical circuit.

3. Drain engine oil and dispose of it in an environmentally acceptable manner.

4. Disconnect choke rod and throttle lever from carburetor.

5. Be sure that gas tank valve is in the closed position, then remove gas line from carburetor.

6. Disconnect muffler assembly from exhaust manifold.

7. Remove exhaust manifold and intake manifold/carburetor assembly.

8. Remove oil return pipe and valve cover.

9. Remove engine splash pans.

10. Remove flywheel inspection cover (it has three bolts and is just behind the oil pan).

11. Remove oil pan (remove oil pump if you know how to replace it, otherwise leave it alone).

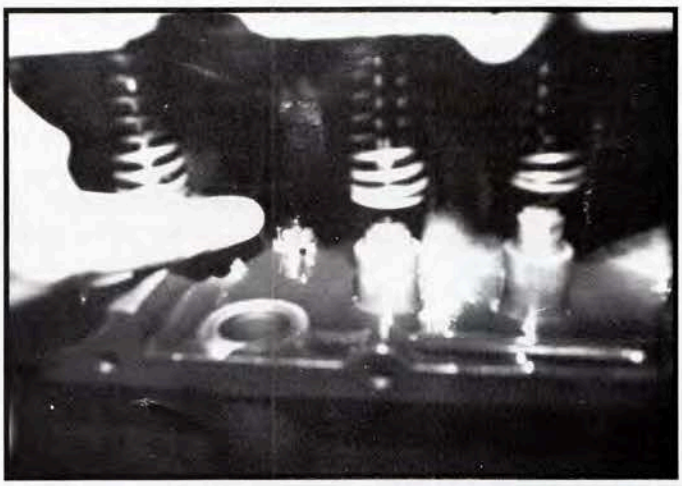
12. Remove all four spark plugs.

Bearing Measurement and Adjustment

Make some sort of plan, then follow it. I did the center main first since it is easy to get to, then the front main, and finally the back main. For the rods, I did them numerically, one through four. Do one bearing at a time and finish it completely before moving to the next. Following these steps for each of three main bearings and each of four rod bearings:

1. With your hand crank, turn the engine over a few times to get a feel for the resistance, or "drag." The amount of drag you feel while turning the engine over indicates the clearance between the bearings and the crankshaft. At this point, it should turn over with little resistance. When you get to the point in which you are making that clearance smaller, you will want to be sure you don't get it too small. So for now, keep in mind how freely it turns in this step.

2. Remove the cotter pin from each of the two bolts that secure the bearing cap. On the center and front mains, the cotter pins are on the top end of the bolts. The reason you had to remove the valve cover is to access the right bolt on the center main. The top end of it is in the valve chamber. On the rear main and all four rods, the cotter pins are on the bottom.

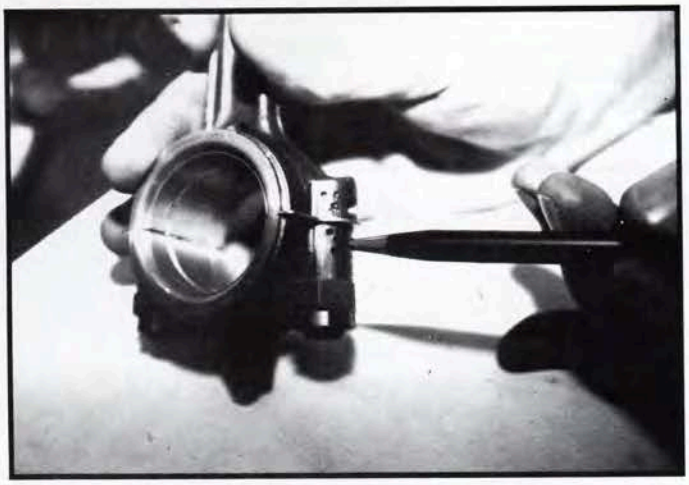


Here's the top end of the right bolt for the center main bearing in the valve chamber. The distributor/oil pump drive gear assembly has been removed for clarity.

3. Remove the nut from each of the two bolts. On my center and front mains, a 5/8" socket fit the square head on the bottom end of the bolts. I needed a 21/32" socket on my rods.

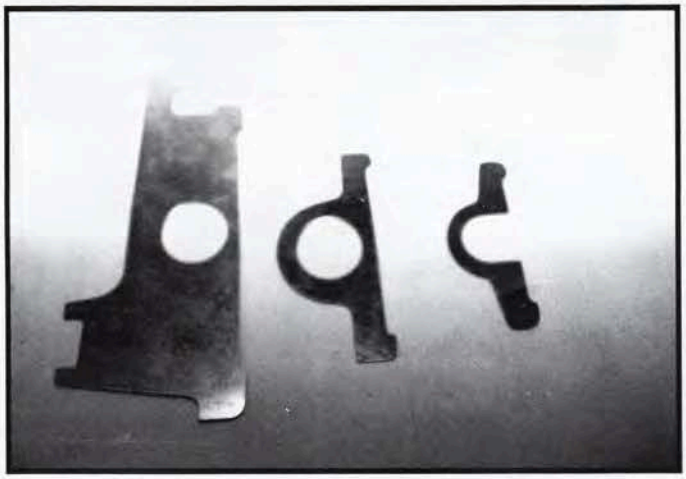
4. Be sure you are aware of its orientation, then remove the bearing cap. The orientation is important because you must put it back the same way. Look for reference marks, such as numbers or small depressions, one on one side of the cap (the bottom half) and another on its mate (the top half). If there is no mark, then go ahead and mark it yourself. Use a punch or whatever you are comfortable with. Also be sure to keep each shim stack on the proper side of

the cap. The shim stacks are important to maintain proper clearance.



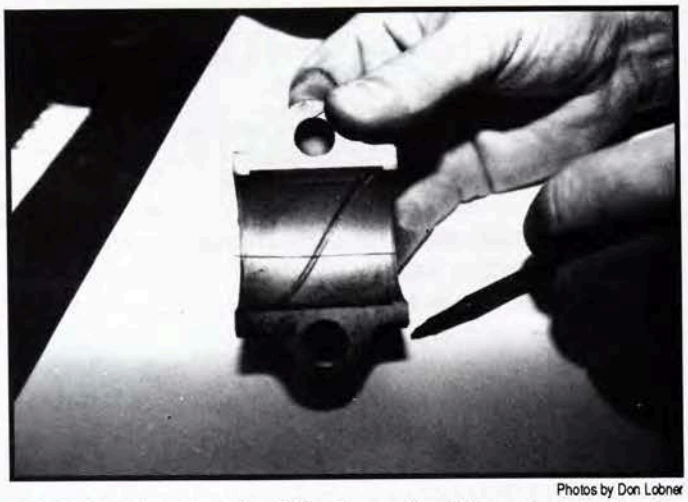
Shown here are small punch marks that indicate that the rod and cap are mates. After the cap is removed, it must be put back so the punch marks match up with those on the rod.

Here's something to look for: with your main bearing shims, it's important that each has a hole that allows the bolt to go through it. Some mechanic before you may have tried to save time by "slotting" the main bearing shims. Main bearing shims with holes that surround the bolt will form a seal that keeps oil from working its way up the length of the bolt. If oil finds its way up the bolt, it will leak outside the engine at the nut end. If you have slotted main bearing shims, you should replace them with ones that have not been slotted. With the rod bearing shims, it's okay if they are slotted since the rod bearings and bolts are completely within the crankcase.



These are the three proper types of shims. The left one is for the rear main bearing, the middle one is for the center and front main bearings, and the right one is for the rod bearings.

5. Wipe away the oil from the bearing cap and crankshaft journal, then cut a piece of Plastigage about one inch longer than the cap is from front to back. Cut the package and all, then separate the paper to remove the Plastigage. Lay the Plastigage across the bearing surface at the bottom of the half circle. Keep the paper because you'll need it to measure the width of the Plastigage in Step 7.



Photos by Don Lobner

This is how the thin strip of Plastigage should be put on the bearing surface of the cap.

6. Carefully put the cap, with the Plastigage in place, back on the engine and secure it with the two bolts and nuts. If you want, go ahead and torque them to specification (70 to 80 Ft./Lbs. for main bearings and 45 Ft./Lbs. for rod bearings). It is not mandatory that you torque them, however. You can just get them "good and tight" if you want. Many a Model A has never seen a torque wrench.

7. Remove the cap again, carefully so as not to disturb the Plastigage, which will be stuck to either the cap or the crankshaft. Take the piece of Plastigage wrapping paper and hold it up to the smashed Plastigage to get a reading. The wider the smashed Plastigage, the closer the clearance. After taking a reading, be sure to remove all the Plastigage from the bearing and crankshaft.

8. Visually check to see that your babbitt and crankshaft bearing surfaces, commonly called "journals," are in serviceable condition. The same characteristics that are required of more modern insert-style bearings are basically required of babbitt bearings. There should be no pieces of bearing surface missing, there should be no signs of melting, and there should be no grooves, other than the oil grooves, except for *very* small ones. The journals should look relatively smooth and shiny.

Since the rear main bearing establishes the "thrust" clearance of the crankshaft, you need to inspect those thrust surfaces. Thrust is the amount of movement the crankshaft moves back and forth between the front and the back of the engine. There is a thrust surface on the front and back portion of the rear main bearing. Again, look for missing, melted, or otherwise poor bearing conditions.

If the bearings and journals are in serviceable condition, the goal then becomes to get the oil clearance as close to, *but not less than*, .001". You do this by removing shims from the shim stacks, which makes the inside circumference of the bearing smaller, and reduces the oil clearance.

When I did my bearings, everything was going along fine until I got to the point with my first bearing where I had to figure out what shim combination would give the desired clearance. My shim stacks consisted of all .003" shims. When I took out one shim on each side, the bearing was too tight. When I put them back, it was too loose. This is where the variety of shims I got from someone who had recently done this came in handy. With that first bearing, I was able to remove two .003" shims from each side, then



Here's one of the thrust surfaces on a rear main bearing cap. The other is on the opposite end of the cap.

put in one .005" shim on each side. With some simple math, I figured out the resulting difference on each side was .001". There are some excellent tips dealing with this very process in the July/August 1991 Tech Q&A column of *The Restorer*.

You should try to remove shims in pairs; in other words an equal number and thickness from both sides. But ultimately you can remove one from only one side to get the proper clearance. It would probably not be a good idea to do this with shims larger than .002", however. Try to use some simple math, then mix and match pairs with various thicknesses to achieve the proper clearance. A micrometer will allow you to determine the thickness of the shims you have. For every .001" you remove from both sides, you get a corresponding .001" reduction in oil clearance.

The most common method of obtaining the proper clearance for main bearings after taking the initial Plastigage reading seems to be the feel or drag method already discussed. Start removing shims, replacing the cap and tightening everything down until the crankshaft does not turn over at all, or gives significantly more resistance, with the hand crank. At this point, you'll want to put shims back because the oil clearance is too tight. After I obtained what I thought was a good feel, I took a final Plastigage reading just to increase my comfort level. Those final readings confirmed the validity of the feel or drag method. I guess you just can't argue with the tried and true methods of experienced Model A mechanics.

For the rod bearings, the best way for me was to partially forego the feel or drag method, and just use Plastigage after each sequence of shim removal. After obtaining the desired clearance for each rod, however, I did give the crankshaft a roll to be sure I didn't get things too tight.

9. For all bearings, after obtaining the proper clearance, spread a liberal amount of Lubriplate on the crankshaft and bearing surfaces. Then replace the cap and secure everything in the manner you prefer ("torque" or "tight"). Install new cotter pins. That's a process you'll have to learn all by yourself! It's an art, not a science. I did learn from a seasoned Model A mechanic that swapping nuts when it seems it just won't work can increase the likelihood of getting the cotter pins to line up with the holes in the bolts.

Assembly Steps

1. Replace the oil pan as follows: Clean all gasket surfaces. Apply some #2 Permatex to all gasket surfaces, except where the rope piece goes in the front of the pan. Insert the oil-soaked rope piece into the front end of the pan. You will probably have to cut to the proper length the cork piece that fits into the groove on the rear main bearing cap. I've learned the hard way you don't want to cut it too short. The ends should fit very snugly up against the engine block. The second time I did it, I made sure it was long enough. Then I applied a liberal amount of #2 Permatex to the surface that the oil pan pushes up against and had no leak. If you have engine pans, don't install the two oil pan bolts that also hold on the engine pans; wait until you install the engine pans.

2. Replace the flywheel inspection cover.

3. Replace the valve cover by first cleaning all gasket surfaces, applying some #2 Permatex to those surfaces, then applying the new gasket.

4. Replace the oil return pipe with the new gaskets. I used the O-ring style and some blue RTV silicone gasket-making material to hold them in place. Again, cleaning all gasket surfaces is important.

5. Replace the exhaust and intake manifold assemblies with the new gasket. Don't use any gasket sealant on this gasket.

6. Connect the muffler to the exhaust manifold.

7. Replace gas line.

8. Reconnect choke rod and throttle rod to carburetor.

9. Fill engine with the proper amount of new oil.

10. Spin engine over with hand crank fairly quickly for ten or more revolutions.

11. Replace the spark plugs.

12. Reconnect battery to electrical circuit.

Break-in Procedure

Once you think it is all back together, mentally and visually go over everything to be sure that all is replaced and secure, then start the engine. As it is running, take a quick look and listen for anything unusual, and shut the engine down quickly if you suspect something is wrong.

Otherwise, while the engine warms up, keep an eye and ear on things. After the engine is good and warm, shut it down and re-tighten everything that you can, such as the oil pan, valve cover, and manifold bolts. If you're confident all is okay, take your car out for a "road test," and when you're back, re-tighten everything again. Within the next month, you will want to re-tighten everything one more time to stop any leaks.

Summary

With proper attention, a Model A can probably run forever. Damage to the crankshaft and associated bearings can be a costly result of improper maintenance. Besides the cost, you'll have to remove the engine from your car if the bearings need to be poured again. The foregoing procedure is relatively simple and won't cost you much money to perform.

Although not covered in the procedure, you may want to consider other maintenance while the engine is apart, such as renewing your oil pump and drive gear, and maybe overhauling your distributor. While it is not removed in the bearing clearance procedure, you may want to remove the head and do some valve or piston ring work while you're at it.

One thing you should do for sure - save all the shims you have left over so the next guy you know doing this to his Model A can get started!