Doubling the Flow Area of a Model A Oil Pump

11 September 2022

This guide is a working document that will be updated as needed. The latest update will have a date published under the title, and available at this website (http://www.modelaengine.com/).

Please call our attention to errors, omissions, unclear language, and material that should be added so we can make the corrections.

It was a surprise to me and other engine builders that a high-volume oil pump is not needed for the "New Model A Engine". The "old rule of thumb" is 10 PSI of oil pressure is needed at the bearings for every 1000 RPM. Greater pressure at lower RPM's is not needed but does no harm.

This "Guide" is changed from previous versions because "High-Volume" oil pumps are not needed, and the on/off "digital" pop off valve from McMaster Carr has been superseded by an "analog" modulating adjustable relief valve designed for a Model A oil pump.

The following modifications are still applicable for those that want the added insurance that their will be adequate oil delivered over the RPM range.

Several steps are illustrated with pictures will show how the passages in a Model A oil pump can be doubled in area to provide more volume for the new Model A engine.

Please note that a Bridgeport mill and metal lathe were used, and every setup was rigid.

Depending on the accessories that you have, your setups will vary, but they should be similar and must be rigid.

Machining suggestions are given as an aid to getting good results.

Handheld tools and a drill press are not adequate tools and will likely result in injury and ruined parts.

Original Oil Pump Design

Several changes were made to the Model A oil pump during production, and they have been documented by Steve Plucker at: (http://www.plucks329s.org/pdf/studies/OIL_PUMP_ASSEMBLY.pdf)

Early oil pumps with a forged body are not candidates to be modified.

Later oil pumps with a cast iron body can be modified to double their flow area, and this is what is article describes.

The original cast iron design of a Model A oil pump has an inlet window to the gears that exposes about 50% of the gears.

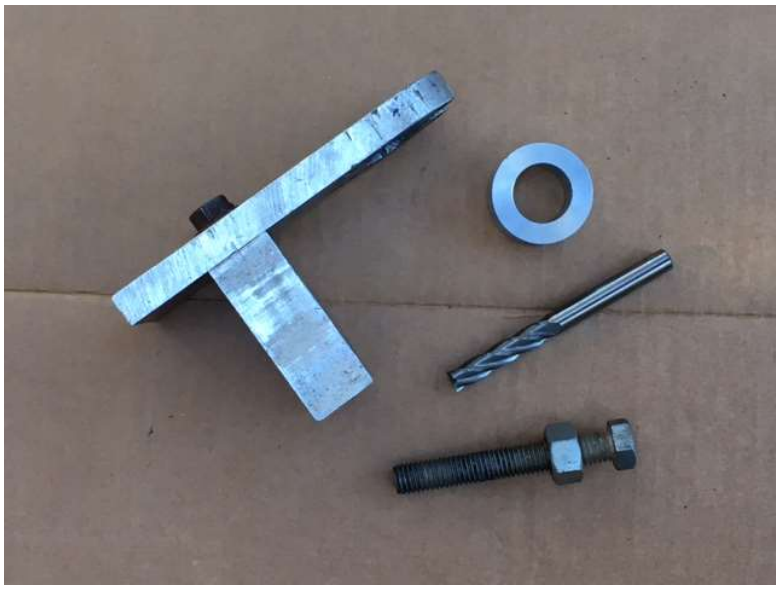
The original design has a 1/4-inch diameter vertical hole above the gears which mates with a 1/4 inch horizontal hole. The area of these 1/4-inch holes is .049 sq in.

The horizontal hole above the gears mates with the vertical passage that contains the drive shaft. The drive shaft is 1/2-inch diameter and the housing bore is .600 inch diameter and reamed to .625 at the ends for the bushings. The area between the shaft and housing bore is .283 - .196 = .087 sq in.

There are 2 slots or round holes near the top of the housing where the oil exits the pump. If round holes, the 2 round holes are .210-inch diameter each for a total area of .069 sq in.

Modified Oil Pump Design and Machining Details

An oil pump holding fixture needs to be fabricated along with a few other aids. Picture 1 shows the fixture along with the other aids.



Model A oil pumps were manufactured by different suppliers and there are small differences. Some oil pumps have a plug blocking the 1/4 inch drilled horizontal hole and the plug needs to be brazed in place, while others have the hole as a part of the casting and do not have the plug. Picture 2 shows a brazed plug.



Picture 3 shows the vertical hole and the old lower drive shaft bushing that needs to be removed prior to machining.



Remove the old lower bushing as shown in picture 4.



The 1/4 inch vertical and horizontal oil passages above the gears need to be enlarged to 3/8 inch with a 4-inch long 3/8 end mill. Both passages can be enlarged at the same time by milling a 3/8-inch-wide slot from the existing 1/4 vertical hole to the .625 housing bore. The area of the new vertical 3/8-inch diameter hole is .110 sq in, and the area of the

horizontal 3/8 square hole will be .141 sq in. Consider plunge milling instead of side milling to lessen the chance of end mill breakage. Picture 5 shows the slot being machined. Note the bolt and nut at the top of the oil pump that bear against the Bridgeport table for rigidity. Picture 6 shows the finished slot. The slot will be blocked when the lower bushing is installed.





Carefully measure the depth of the slot and the length of the new lower bushing. If needed, shorten the lower bushing to provide a 3/8 x 3/8 inch square hole between the vertical 3/8 inch diameter hole and the housing bore. Install the bushing as shown in picture 7.



The oil intake opening needs to be enlarged. Picture 8 shows the setup and the intake opening being enlarged. Do not cut into the surface where the upper ends of the gears mate with the oil pump housing.



Remove the old upper bushing and install a new bushing in its place.

The oil pump drive shaft between bushings needs to have its' diameter reduced to 7/16 inch. See picture 9. The area for oil flow between the .600 inch diameter housing bore and the 7/16 inch shaft diameter is .132 sq in.



The 2 oil exit holes at the top of the oil pump need to be enlarged to 5/16-inch diameter using the setup shown in picture 10. Note how the upper end of the oil pump is supported to provide rigidity. The area of the 2 exit holes is .153 sq in.



Final Assembly Notes

Before assembly, thoroughly clean all parts to remove any machining debris.

Gear housings can be worn and replacement gears in rebuild kits can be shorter than original.

Both gears need to have the same height and the clearance at the bottom cover must be .002 inch maximum. A larger clearance will have an effect at slow (idle) speed oil pressure. Oiled Plastigage or a straight edge and a feeler gage can be used to measure clearance.

During assembly, lubricate the bushings and gears with motor oil or assembly lube.

Do not use a gasket at the bottom plate.

Verify that shaft and gears rotate without binding.

To Summarize

The oil intake opening to the gears has been enlarged to be twice as large.

The vertical oil hole was .049 sq in, and modified to be .110 sq in.

The horizontal hole was .049 sq in , and modified to be .141 sq in.

The shaft/housing oil passage was .087 sq in, and modified to be .132 sq in.

The 2 oil pump exit holes were .069 sq in, and modified to be .153 sq in.

The smallest passage in an original design pump is .049 sq in, and in the modified pump is .110 sq in. That is a change of 225%.

Oil Pressure Relief Valve

Depending on internal pump leakage, downstream restrictions, temperature, and viscosity of oil chosen, the modified Model A oil pump may deliver too much oil resulting in high pressure that can overload the

oil pump drive gear (Ford part A-6551) or cause the A-6570 spring to compress.

Incorporating an oil relief valve in the oil pump will prevent overloading.

When this guide was originally written, the McMaster Carr #4772K6 relief valve was recommended because there were no better choices. The operation of the McMaster Carr relief valve is digital because the valve is either closed or open.

The new relief valve designed for the Model A or other oil pumps is analog because there is no seat to close and there is always a small amount of oil leakage. When the "set pressure" is reached, the piston deflects to start opening 6 relief holes to divert excess volume and maintain pressure. The "set pressure" is adjustable by adding or removing washers.

The new relief valve is available at www.burtzblock.com

The instructions on how to install and adjust the new relief valve follow.

Model A Oil Pump Relief Valve and Collar

05 Sept 2022

1) A completely stock original Model A oil pump, modified Model A oil pumps, and aftermarket pumps all provide a greater volume of oil than needed for the "New Model A Engine". The volume of oil that these oil pumps deliver increases as engine speed increases.

2) The enclosed analog relief valve was designed for the "New Model A Engine" to prevent excessive oil pressure that will result in gear wear, wasted horsepower, and unneeded churning and heating of the oil. To maintain the same set pressure as oil volume increases, the piston in the relief valve moves to increase the area of the vent holes and maintain the set pressure.

3) The “Old Rule of Thumb” states that 10 PSI of oil pressure is needed at the bearings for every 1000 RPM.

4) When used with a Model A oil pump, a 1/8-27 NPT threaded hole needs to be added to the vertical section of the oil pump at 1.75 inches below the oil pan/cylinder block mounting surface for the relief valve.

5) The new relief valve consists of a housing, piston, spring, 6 washers, and a cotter pin.

6) The relief valve comes assembled with 4 washers and has an opening pressure of 31.5 PSI. The cotter pin legs are not bent on this assembly.

7) There will be a small pressure loss when using an oil filter, so you may want to set the relief valve to a slightly higher pressure.

8) The opening pressure is adjustable by adding or removing washers. For each washer added or subtracted, the opening pressure changes by 3.7 PSI. To change the number of washers, hold the relief valve in a vise and use a pair of needle nose pliers to straddle the cotter pin and push on the washers to compress the spring.

9) Determine your operating RPM, and then select and install the number of washers that you want to use, after the washers and cotter pin are installed, bend the legs of the cotter pin to keep the assembly together.

10) A rigid setup is required to drill and tap the hole in the side of the oil pump. A center drill, tap drill, and the 1/8-27 NPT tap all need to be used and held in the chuck of a rigid machine while the oil pump is held in a vice.

11) Do not attempt to drill and tap the hole by using hand tools. You will likely drill a crooked hole, you will be unable to start the tap correctly, and there is the possibility that you will get hurt and destroy your oil pump.

12) Use caution when tapping the hole. A hole that is tapped too deep will restrict the flow path for entering oil. If the hole is tapped too deep, the end of the relief valve will need to be shortened to provide a flow path. If a stock Model A oil pump is being rebuilt for the “New Engine”, it is recommended that a rebuild kit with a driveshaft (A-6608) that has a reduced diameter between bushings be used, and don’t use the gasket (A-6619) between the cover (A-6616) and oil pump body unless needed.

13) When an oil filter is used, the collar fits on the top of a Model A oil pump to block the slots and direct all oil out the side of the cylinder block to an oil filter.

14) Attached are pictures of the rigid setup to drill and tap the hole, and pictures of the various parts and the assembly.







