

New Model A Engine Builders Guide

24 October 2023

Congratulations and thank you for your purchase of the "New Engine Kit" (Cylinder Block, Crankshaft, and Connecting Rods) that you can use to build a Model A engine that will replace the frail original parts but looks completely stock on the exterior.

You will need to supply all other parts to build an engine. The new engine can be built as stock, or it can be built for higher performance.

We ask that you (or your engine builder) consider using our recommendations in this guide to build an engine. If there is a conflict, please use your engine builder or parts supplier's recommendations with the understanding that they will assume responsibility for their work.

This "Builders Guide" is **not** an assembly manual and there are no specific recommendations regarding add-on parts needed to assemble a complete engine.

Please read this Builders Guide and make a list of parts and supplies needed as you read the guide. Equivalent substitutes of parts, lubricants, and sealants are acceptable.

There are 2 additional guides that accompany this "Builders Guide" and they can be found at www.modelaengine.com under the tab "Guides", and they are titled "Doubling the Flow Area of a Model A Oil Pump", and "Installing an Oil Filter".

This "Builders Guide" is a working document that will be updated as needed. I wish to thank all builders for their comments because I use those comments to update the "Builders Guide". The latest update will have a date published under the title, and the latest version will be available under "Guides" on this website. (<http://www.modelaengine.com>)

Please help us improve this "Builders Guide" by calling our attention to errors, omissions, unclear language, and material that should be added so that we can make the corrections needed for future engine builders.

If you are an engine builder that understands a modern engine along with the “New Model A Engine”, or if you are a parts supplier and want your business mentioned in section 18) of this guide, please contact me at model.a.engine@hotmail.com.

For quality control purposes, every cylinder block has a unique hidden serial number located on the gasket surface behind the timing gear inspection cover A-6017 and is part of our strict Quality Assurance process that allows us to know when a problem occurs.

As an example, cylinder block 230530030837 was completed on May 30, 2023, and was the third one that passed the final inspection on that date. The first 2 digits indicate the year. 23=2023, The second 2 digits indicate the month. 05=May. The third 2 digits indicate the day, 30=May 30. The fourth 2 digits 03 indicate the number in the sequence of engines that passed final inspection on that day. The last 4 digits are the total number of cylinder blocks produced to date that have passed final inspection, so this is the 837th engine that passed final inspection.

If you find a Quality Assurance problem, don't hesitate to get in touch with us about the problem and provide your serial number.

Most “New Engine” buyers are people with home shops and a basic understanding of an engine. The “New Engine” is ready for assembly after deburring and cleaning. There is no need for any machine work that will void your warranty.

If you are not able to build the engine yourself, we strongly recommend that you have your new engine built by a professional mechanic who has the knowledge, experience, and equipment to ensure a product where he can guarantee his work. THIS IS NOT AN ANTIQUE ENGINE. You or your engine builder must be familiar with new MODERN engines built after 1955.

Please do not let your engine builder talk you into any cylinder block modifications that may void your warranty. We do not warrant

any machine work done to our parts. To save money, you can do the de-burring of the new parts and clean up the bolt-on parts which is time-consuming. Several cautions in this guide are here because home builders and “Old Time Model A Engine Builders” do not have experience building a modern engine.

CA Proposition 65 Warning

Breathing air in the area where the “New Engine” is, or contact with the “New Engine”, solvents, lubricants, sealants, paints, valve grinding compound, and almost every other part mentioned in this “Builders Guide” is known by the state of California to cause cancer and birth defects or other reproductive harm. Do not stay in the area of engine assembly longer than necessary.

Table of Contents

Building the New Engine

- 1) Inspection
- 2) Common Sense and Assembly Sequence
- 3) Oil System Options
- 4) Oil Pressure Monitoring
- 5) Recommendations Regarding Adhesives and Sealants
- 6) Recommendations Regarding Lubricants
- 7) Recommendations Regarding Add-On Parts
 - Bearing Inserts
 - Cylinder Block Recommendations
 - Crankshaft Recommendations
 - Connecting Rod Recommendations
- 8) Cleanliness
- 9) Recommendations Regarding Tolerance
- 10) Recommendations Regarding Fastener Torque
- 11) Recommendations Before Starting Engine
- 12) Optional Flywheel
- 13) Optional Camshaft
- 14) Optional Head

Reference Material

- 15) Detailing the New Engine for Judging
- 16) Project History, Design Details, Pictures, and Videos
- 17) Web Resources
- 18) Education, Resources, and Making a Decision
- 19) Replacement Parts
- 20) Contact Information
- 21) Liability and Guarantee
- 22) Unwarranted Modifications
- 23) Cottage Industries

1) Inspection

Please inspect your “New Engine Kit” thoroughly and look to see that all parts are included. The following is the list of parts that are included.

Please do a trial fit with all threaded hardware. The threads should be free running without any tight spots and excessive looseness (wobble). If your 12-point nuts fit loose on the studs, let us know at burtzblock.com and they will be replaced.

Cylinder Block Parts Description

Qty 1, cylinder block with 5 main bearing caps, 4 hard exhaust seats, 5 cam bearings, 10-cylinder block/main cap dowel pins installed, and Qty 4, special small diameter studs with hardware used for line boring of main bearings 1 and 3 (to be discarded after verification of match marks)

The following loose parts are either assembled to the cylinder block or they are packaged separately.

Qty 4, stepped (7/16 UNF x 1/2 UNF) studs for #1 and #3 main bearings

Qty 4, 1/2-20 UNF tall castle nuts for #1 and #3 main bearing studs (Bratton’s 9020)

Qty 4, 7/16 UNC x 7/16 UNF studs for #2 and #4 main bearings

Qty 8, 7/16-20 UNF 12-point nuts for main bearing studs #1, #2, #3, and #4 (McMaster Carr 90759A450)

Qty 2, 1/2 UNC x 1/2 UNF studs for #5 main bearing

Qty 2, 1/2-20 UNF 12-point nuts for main bearing #5 studs (McMaster Carr

90759A550)

Qty 2, 1/2-13 x 3/8 UNC setscrew for main oil galley end plug (McMaster Carr 94105A706)

Qty 5, 3/8-16 x 1/4 UNC setscrew for oil galley plug (McMaster Carr 94105A603)

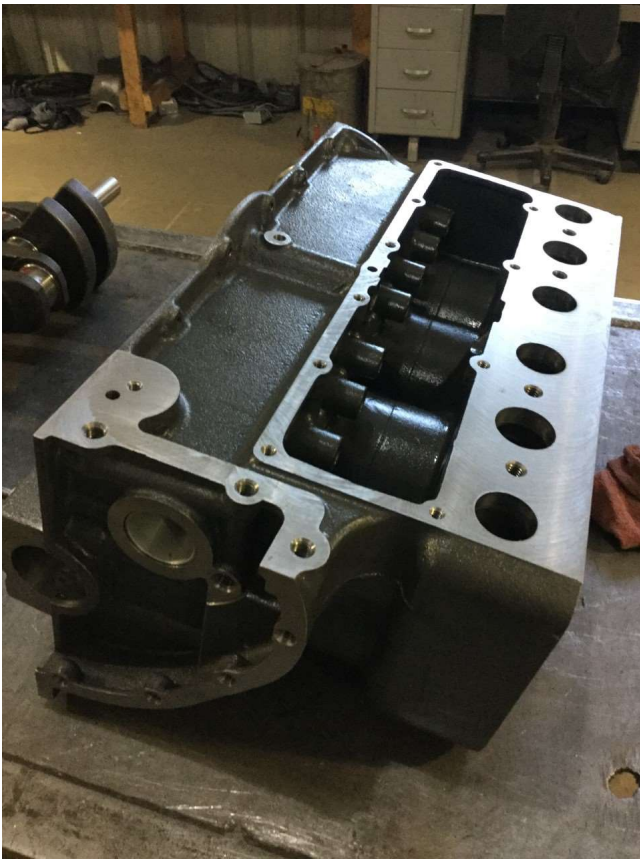
Qty 1, 7/16-14 x 3/8 UNC setscrew for oil galley plug (McMaster Carr 91375A663)

Qty 3, thrust washer half

Qty 6, 8-32 x 3/8 Phillips flat head brass screw for thrust washer halves (McMaster Carr 92480A192)

Qty 10, dowel pin for cylinder block/main caps (McMaster Carr 91585A385)

You will need to supply the 2-cylinder block/flywheel housing dowel pins Snyder's A-6397 and all hardware for parts that are attached to the cylinder block.



Crankshaft Parts Description

Qty 1, dynamically balanced crankshaft with 4 setscrew oil passage plugs. You will also need to supply the 2 flywheel dowel pins (Snyder's A-6387) and a #18 Woodruff key (McMaster Carr 98481A205).



Connecting Rod Parts Description

Qty 4, balanced connecting rods each with wrist pin bushing, 2 dowel pins

(McMaster Carr 91585A385) at the cap interface installed, and 2, 12-point 3/8-24 x 1 1/4 UNF bolts (McMaster Carr 91271A644).



Do not disassemble the connecting rod bearing caps until the match marks are verified. If not present, add match marks before disassembly.

If you find anything missing, damaged, or loose thread fits, please contact our QA Manager, John Lampl, at [burtzblock.com](mailto:john.lampl@burtzblock.com)

Storage

If you are planning to build your new engine in the future and just want to store it, you are encouraged to remove the main caps, remove the corrosion, and reassemble

everything with a coating of oil or a rust inhibitor like LPS 3. LPS 3 should also be applied to the connecting rods. (<https://www.itwprobrands.com/product/lps-3>).

The crankshaft is covered with Cosmoline and needs no added protection.

2) Common Sense and Assembly Sequence

Although the exterior of the “New Engine” looks like a Model A engine, the interior is a new modern engine design.

If you are not familiar with modern engines, please use the services of a modern engine builder who has the knowledge and equipment to build an engine that he can guarantee.

If you are familiar with modern engines (engines produced after 1960) but lack cleaning equipment, please use the services of a modern engine builder to clean your parts. The new engine parts should be cleaned in an aqueous parts washer that has high-pressure jets and uses a detergent that won't damage the cam bushings. Solvent tanks and hot tanks are not recommended.

As the engine is being assembled, rotate the crankshaft for 2 full turns after each part is added. If the connecting rods are installed backward, there will be interference.

If the camshaft, timing gears, and valve train are assembled before the pistons are installed, it will be much easier to rotate the crankshaft to set the tappet clearance.

It is important to verify that there are no open passages or leaks from the pressurized oil system. When the short block is assembled, remove the lower bolt (A-21111) from the Cylinder timing gear cover side (A-6017) and apply 40 PSI air pressure while checking for leaks at the rear main oil galley plug, the castle nuts for main bearings, the interface between the cylinder block and flywheel housing, the rear main seal, and the interface between the rear main bearing cap and cylinder block. A bubble-blowing solution of soap and water is ideal for checking for leaks.

We recommend that a clean radiator, thermostat, and antifreeze be used.

Don't be afraid to ask questions (model.a.engine@hotmail.com) or have an experienced mechanic or shop that is familiar with modern engines help you.

All castings and forgings were made using hard (metal) tooling and the same CNC programs are being used to machine the components of the “New Engine Kit”.

With hard tooling, proven CNC machining programs, pressure testing after machining, and QA, there is very little chance of having bad parts.

The first production run had 3 inexperienced engine builders that had problems. The first builder thought that some of the main bearings were bored on different centerlines, the second builder thought that 2 of the 5 main bearings were bored with oval holes and needed to be shimmed to become round, and the third builder didn't understand “bearing crush”.

After multiple emails and phone calls, all 3 of these imagined problems were proven to be false when the “Builders Guide” was followed.

Please don't plan on building an engine that can continuously keep up with modern traffic. Fast acceleration and short bursts of speed are fine like passing slower traffic or entering a freeway on-ramp but attempting to continually keep pace with modern traffic may result in other problems (skinny tires, aerodynamics of a brick, antique suspension, and light steering caused by air under the front fenders) and is not recommended.

We are confident that the new engine will survive short bursts of speed because we assembled the "Engineering Evaluation Engine" and then broke it in by intentionally abusing it to see if anything would break by starting it and then running it continuously at 3100 RPM (75 MPH) for 6 hours, and nothing broke.

We recommend that you break your new engine in at varying speeds, but not over 2400 RPM (58 MPH) for the first 1000 miles.

If all parts are available, you should have a running engine in less than 3 days. We spent a lot of time measuring things and had a connecting rod bolt interference problem that needed to be solved when we built the “Engineering Evaluation

Engine” that was running in 2 1/2 days. This engine was built at Bert’s in Englewood, Colorado and the parts were cleaned using a solvent tank and compressed air.

Assembly Sequence

- 1) Please read this entire “Builders Guide”.
- 2) See section 1) to inspect and deburr all parts.
- 3) See section 3) regarding oil system options.
- 4) See section 18) and decide what you want to build.
- 5) Analyze your capabilities. Do you have the equipment and knowledge or do you need professional help?
- 6) Follow sections 3) through 11) to build your engine.
- 7) Reread section 2) Common Sense to check for leaks, “break-in” instructions, and not continuously keeping up with modern traffic.

Special Tools

Any special tools needed like a piston ring compressor, valve spring compressor, camshaft bushing remover, torque wrench, and others can either be borrowed or rented from an auto parts store or bought at Harbor Freight.

3) Oil System Options

Building the new engine to appear stock requires no changes to the new cylinder block.

If desired, the new engine can be built to utilize a full-flow oil filter. Go to www.modelaengine.com and click on the tab "Guides". Here you will find "Installing an Oil Filter" and the modification of 2 holes in the cylinder block that will create chips that need to be cleaned before engine assembly. The modifications required for an oil filter can be reversed in the future so the cylinder block will again look to be original for an engine that will be judged in fine points judging. One of the new engines was in fine point judging at the 2022 MAFCA National Convention in Kerrville, Texas, and I am unaware that there was any deduction for having a new engine.

The old "rule of thumb" and our recommendation is that the oil pump chosen needs to provide a volume of oil that will provide 10 PSI at the bearings for every 1000 RPM.

At idle, a hot oil pressure of 5 PSI is adequate. If you have a 1957 Chevrolet Bel Air with a 283 cubic inch engine (one of the engines using the same bearing inserts as the "New Model A Engine"), the dash has "idiot lights" instead of gauges and the oil light comes on if you have low oil pressure. If you search on AutoZone for a replacement oil pressure switch for the car above, it will take you to

https://www.autozone.com/external-engine/oil-pressure-switch/p/duralast-oil-pressure-switch-ps117/123828_0_0

If you look at the specifications for the PS117 switch, you will see that the switch opens between 3 and 5 PSI to turn the "idiot light" off.

A stock Model A oil pump with close-fitting gears has been found to provide more than adequate volume and a relief valve is needed to bleed off the excessive volume at high RPMs to maintain an oil pressure that won't overload the drive gears and waste horsepower.

The relief valve found at www.burtzblock.com is suitable for stock or modified Model A oil pumps that provide more volume.

To guarantee an adequate volume of oil, a stock oil pump can be modified to provide greater flow. Go to www.modelaengine.com and click on the tab "Guides". Here you will find "Doubling the Flow Area of a Model A Oil Pump".

A brand-new Model A oil pump using stock gears that has a built-in relief valve that is a part of the casting is available from Leonard Nettles. Leonard Nettles contact information is in Section 18) of this “Builders Guide”.

A new pump can be purchased from Bill Stipe (<https://www.specialtymotorcams.com/>), or Joe Sivils (Turlock Machine). Both oil pumps utilize SBC (Small Block Chevy) oil pump gears.

Dan Price also makes a new pump utilizing Oldsmobile gears.

The contact information for these suppliers can be found in section 18) of this “Builders Guide”.

The pump chosen must be configured to deliver all oil internally (no filter) or deliver all oil externally (filter).

Engine builders that are using the Stipe oil pump have found that it delivers too much volume resulting in high oil pressure even when the weaker green relief valve spring is used. Stipe now offers a spring that is weaker than the green spring and they claim that it solves the problem. You need to ask for the weaker spring when placing an order, or if you already have a Stipe pump, just ask them and they will send one. The high oil pressure problem can also be solved by using a SCAT #50073 Dry Sump Oil Filter Bracket that has a large built-in relief valve to bleed off the excessive volume to reduce the pressure. Relieved oil must be returned to the crankcase through an additional oil line. If the Stipe oil pump is used without a filter, a means of reducing oil pressure within the crankcase must be devised. Lawrie in Australia has shortened the gears and housing of a Stipe oil pump to .787 inches (20 mm) and reports that the reduced volume does not overwhelm the Stipe 35 psi relief valve that is part of the pump.

We recommend that an oil pressure relief valve set no higher than 35 PSI be used. Higher pressures will subject the oil pump/distributor drive gear (A-6551) to higher stresses, and disengagement by compressing the drive gear retaining spring (A-6570). The installed stock retaining spring exerts a downward force of 32 pounds, and at 40 PSI the upward force from the oil pressure is 27 pounds. For added insurance, a stronger spring (McMaster Carr 9657K552) that will exert 60 pounds of downward force can be used.

The horizontal 5/16-inch oil passage hole that is behind the valve chamber gasket in the center of the cylinder block can be tapped 3/8-16 UNC and a short setscrew installed to retain the A-6560 Oil Pump Drive Bearing. This setscrew will eliminate the need for the McMaster Carr 9657K552 spring.

We recommend that a clamp be fabricated to hold the oil pump chosen in place. A 5/16 UNC tapped hole is provided in the new cylinder block for the clamp.

The following photo shows a modified Model A oil pump with the pressure relief valve and a collar (Both available at burtzblock.com) to direct all oil to a filter.



4) Oil Pressure Monitoring

If you look at the bottom of the valve chamber cavity, there are 2 oil passages from the main oil galley that connect to 2 valve cover bolts. These passages can be used for an oil pressure gauge and/or provide oil for an overhead valve conversion. To utilize these oil passages, a special bolt with a hole through the middle needs to be made from 1/2-inch hexagon stock. One end is threaded 5/16 -18 x 3/4 UNC and the other end is threaded 1/8 NPTF. The special bolt is shown in the following picture. The special bolt is also available at burtzblock.com.



5) Recommendations Regarding Adhesives and Sealants

We recommend that Permatex #2, 80011 be used to seal the rear main bearing cap/cylinder block interface and around the outside diameter of the front crankshaft seal.

We recommend that Permatex 20539 Indian Head Gasket Shellac be used on the cylinder block side of the flywheel housing, oil pan, and valve chamber cover gaskets.

We recommend either Permatex 80045 Pipe Joint Compound, or Loctite Blue Threadlocker be used to seal and retain setscrew plugs and other fasteners.

We recommend Permatex “The Right Stuff” because it is a good sealant that can be used in many places. This is a flexible RTV sealant that resists oils and coolants.

We recommend J-B Weld SKU: 50197 High Heat Epoxy for disguising the rear main oil galley plug to pass fine point judging. See section 15).

Do not use excessive amounts of adhesives or sealants because chunks could break off and clog the oil pump intake.

Use acetone to clean parts before the application of adhesives, sealants, and epoxies. Do not use diesel fuel, paint thinner, turpentine, kerosene, or similar solvents to clean parts because the oily residue will prevent adhesion.

6) Recommendations Regarding Lubricants

We recommend that Permatex 81950 Ultra Slick assembly lube be used on all parts that are in contact and slide or rotate including seal rubbing surfaces.

We recommend that the head and manifold studs threaded into the cylinder block be coated with Permatex 80078 Anti-Seize Lubricant to make future removal easier.

As a minimum, we recommend that 10w-40 or 20w-50 motor oil be used both for break-in and thereafter. Better oil is available like Mobil 1 15w-50 (< \$25 for 5 quarts at Walmart) or you can use 10w-60 full synthetic which is even better.

7) Recommendations Regarding Add-on Parts

All interfaces on the new cylinder block, crankshaft, and connecting rods where parts are attached are identical to those found on Ford drawings A-6015, A-6303, and A-6200. In other words, if a part fits an original Model A engine, it will fit the new cylinder block, crankshaft, and connecting rods.

All threads in the new cylinder block and connecting rods are either UNC, UNF, or NPT. There are no metric threads.

Add-on parts, whether new, used, or NOS, need to be cleaned and inspected for wear and flatness. Flatness is critical at the cylinder block/head interface, cylinder block/manifold interface, and cylinder block/oil pan interface.

Bearing Inserts

We recommend that all 12 pairs of bearing inserts be Clevite CB-745P, Federal-Mogul 2020cp, Vandervell VPR673, King Cr803XPN, or ACL ACL88745H, all of which are TriMetal. Buy standard-size bearing inserts. These bearings were used in General Motors engines from 1955 through 2003 in 265, 283, 302, and 327 V-8s, 194, 215, 230, 241, and 250 straight 6's, and 1.8, 2.0, 2.2, 2.3, and 2.5 L straight 4's.

The bearing insert fits into a bore of 2.1247/2.1252 inches, has a maximum wall thickness of 0.0621 inches, and is designed for a shaft diameter of 1.9990/2.0000 inches.

At the extremes of tolerancing, the oil clearance will be 0.0010/0.0035 inches. These dimensions are from the Clevite "Light Vehicle Engine Bearings" catalog EB-20-18 (<https://www.mahle-aftermarket.com/media/local-media-north-america/pdfs-&-thumbnails/catalogs-and-literature/engine-bearings/eb-20-18.pdf>)

The first part of the Clevite catalog has a lot of good information regarding insert bearings, and pages 15, 16, and 17 describe the differences between Babbitt/Copper/Steel TriMetal and Aluminum-Silicon/Steel BiMetal bearings.

We recommend that the main and connecting rod bearing clearances be verified with fresh oiled Plastigage (SPG-1, range .001 to .003 inch). The oil prevents the deformed Plastigage from sticking to the journal or bearing shell. The ideal clearance is .002 inches.

Clearances for all bearings should be similar. If they are not similar, you may have dirt between mating surfaces, an insert tang may be tight in the notch, or the studs at main #1 or #3 may be hitting the backside of the insert.

Do not apply grease, sealant, or anything else to the backside of the insert because it will affect torque, clearance, and heat transfer.

Cylinder Block Recommendations

After match mark verification and disassembly, the main bearing studs, and associated hardware used during machining for main bearings 1 and 3 need to be discarded. On final assembly, they will be replaced with the special stepped studs (7/16 UNF x 1/2 UNF) and nuts supplied separately.

The water-based cutting solution used for line-boring the main bearings is corrosive and the temporary studs may be hard to remove. The studs need to be removed from the bottom and a slide hammer may be necessary. When we heard of this problem, we asked the factory to grease the temporary studs to mitigate this problem.

The cylinder block main bearing bores were machined to size while assembled. When taken apart, there will be burrs and sharp edges that need to be de-burred. There are also burrs and sharp edges at other locations that need to be removed. De-burring can be done with a Dremel tool, a small mill file, a set of needle files, a

rotary wire wheel brush, and 320-grit wet-or-dry sandpaper. After de-burring, every part needs to be surgically cleaned for long engine life.

While de-burring, verify that the tangs on the bearing inserts fit properly into the notches in all 24 places. If needed, widen the notch slightly to provide clearance.

There is a good chance that the water jacket has some residual core sand that was not removed by the foundry. If the foundry sand is not removed, it can cause hot spots in the water jacket, or act as an abrasive in the cooling system when it becomes dislodged. A short length of small diameter flexible wire rope (McMaster Carr 3332T51) can be chucked in a drill motor and worked through the water passages to dislodge any foundry sand that was not removed.

During the final machine operation of line-boring the cylinder block, a corrosive metalworking fluid was used. Corrosion and chips will be found when the main caps are removed and must be removed by wire brushing. After everything is cleaned, all fasteners should be free running for accurate torque readings on final assembly. If the nuts fit loose on the studs, let us know and we'll replace them with nuts from McMaster Carr.

The upper bearing inserts for main bearings 2 and 4 need a 1/8-inch diameter hole to open the oil supply passage that is in the cylinder block. See the following photo that shows a bearing insert with the added feed hole.



The surface finishes on the cylinder block should not be changed. The top of the cylinder block has a surface finish that will help grip the head gasket and the cylinder bores are plateau-honed with the ideal crosshatch pattern to provide 0.004-inch piston clearance for quick break-in. Our guarantee does not apply to surface finishes that have been modified.

The rear oil galley plug needs to be a ½ -13 UNC setscrew that is epoxied in place for engines that need to be entered in “points” judging where the small cavity is filled in (See section 15)) or it can be a modified button head bolt with a copper washer as shown below. The button head bolts are available from John Lampl at burtzblock.com and will be included in the next run of cylinder blocks.



Stud/Bearing Insert Clearance

The studs for main bearings 1 and 3 are very close to the backside of the bearing inserts. See the photo and verify that there is clearance in both the cylinder block and main caps. If there is no clearance, file the backside corner of the bearing insert corner slightly to provide clearance between the insert and the stud.



If the crankshaft is hard to turn, either a bearing tab is not fully seated, or a main bearing stud is hitting the backside of an insert.

Main Bearing Stud Sealing

The 3 main bearing studs that have nuts on the exterior (2 at main #1 and 1 at main #3) need to be sealed to prevent oil leakage at the tall exterior castle nut.

Methods of sealing can be:

- 1) Epoxy (Loctite 1360700)
- 2) A flexible sealant (Permatex “Black Gasket Maker” 27037) or (Permatex “The Right Stuff” 29208).
- 3) A 10 mm ID x 1.5 mm width O-ring that fits into a 0.079-inch-wide x 0.031-inch deep groove in the 0.500-inch diameter of the stud shank can be machined into the stud. The groove should be located 2.17 inches below the 1/2-20 UNF threaded end. The McMaster Carr part number for the O-ring is 1295N162. This was suggested by Brian Weber. If you choose to use this method of sealing, push the stud up to install the O-Ring where the castle nut is, and then pull the stud down. This method lessens the possibility of damaging the O-Ring on assembly. John Lampl at www.burtzblock.com has the studs with the

O-Ring groove in stock and available for a small cost. On the next run of cylinder blocks, the studs with O-ring grooves will be provided.

4) A packing (cotton string and Permatex #2, 80011). If the decision to use a packing is made, then the Permatex-impregnated string must be wound around the 7/16-inch shank and firmly packed with a curved tool that is .030 inch thick.

5) An O-ring between the 7/16-inch diameter stud and the 1/2-inch bore in the cylinder block. Lawrie in Australia reported that a 1.5 mm cross-section x 10 mm ID (0.059 x 0.393 inch) Viton O-ring worked for him (McMaster Carr 1295N162). A 1 mm cross-section x 10.5 mm ID (0.039 x 0.413 inch) Viton O-ring (McMaster Carr 1295N129) should also work and be a little easier to install. If the choice is made to use an O-ring, the O-ring and mating parts need to be lubricated with motor oil to prevent installation damage.

A tool made from a piece of tubing that is 0.500-inch OD and 0.444-inch ID (McMaster Carr 89955K471) can be used to help with packing installation.

Whenever adhesives or sealants are used, please follow the manufacturer's instructions regarding cleanliness and application.

Please see section 5) regarding the use of acetone to ensure clean surfaces.

Crankshaft Recommendations

Deburr all sharp edges where machined surfaces meet unmachined surfaces.

Please remove the 4-setscrew oil passage plugs to allow thorough cleaning of all drilled oil passages. The easiest and safest way to remove the plastic plugs is to drive a wood or deck screw into them and then pull on the screw with a pair of pliers.

When installing the flywheel dowel pins, please use a C-clamp or some other method that will not bend the flywheel mounting flange.

When installing the timing gear, please use a gear installer that uses the threads for the crankshaft ratchet nut or heat the gear and it will easily slide on. Please do not use a short piece of pipe and a big hammer to drive the gear into place because you may bend the crankshaft.

Crankshaft Thrust Bearings

There is nothing to set on crankshaft thrust. When assembled, you should have a minimum of 0.002 inches.

If you don't have 0.002-inch clearance, simply lay a piece of 220-grit wet or dry sandpaper on a flat surface, and sand the forward thrust half circle on the front of the rear main cap until you have 0.002 clearance. Don't sand the 2 half circles at the rear of the rear main bearing.

Check to make sure that the head of the brass flathead screws that hold the thrust half circles in place are flush or slightly below the thrust surface. Loctite is recommended for these screws.

Connecting Rod Recommendations

The connecting rod can only be installed as shown in the picture. Installing it backward will not allow full rotation of the crankshaft.



The big ends of the connecting rods come very close to the cylinder block walls, oil pan walls, and the camshaft. Verify that there is clearance by rotating the crankshaft for 2 full turns after assembly of each connecting rod/piston assembly.

The connecting rods are balanced in sets to modern engine standards. Each of the 4 connecting rod weights are within a few grams of each other, but the center of gravity is slightly different for each connecting rod. If you are building a race engine or are a perfectionist, please see the YouTube video <https://www.youtube.com/watch?v=QLpiF0E0EJU>

Pistons and Rings

Original Model A pistons are split skirt, have 1/8-inch-wide compression rings, and a 5/32-inch wide oil ring.

Pistons sold by Snyder's and most of the Model A parts vendors are solid skirt, and they use the original width rings. These pistons with wide compression rings will work in the "New Engine" but are not the best choice. Wide rings take a much longer time to seat than narrow rings and can cause crankcase pressure before

seating. The new cylinder block is made from a modern iron alloy and has cross-hatching for narrow rings.

We used EGGE (<https://egge.com>) part number E1104-4 pistons in the engineering evaluation engine. They use narrower compression rings and a wider oil control ring (5/64-inch-wide compression, 3/16-inch wide oil) and they fit with 0.004 inch piston/wall clearance so no honing was needed. The EGGE pistons are solid skirt with an expansion slot that does not extend to the bottom of the piston.

Thin compression rings have less friction and the time required for break-in is much faster. The thin rings have been in use since the 1950s.

If the pistons chosen have expansion slots, the expansion slots need to be assembled on the non-camshaft side (dipstick side) of the engine.

We used Hastings ring set 665. The compression rings are grey iron with a manganese phosphate coating. Do not use hard compression rings because they may take a long time to seat with the new harder cylinder block. If you are building several engines, money can be saved by ordering Hastings ring set 660. Ring set 660 has the same rings as set 665, but there are enough rings for 2 engines.

Silv-O-Lite solid skirt pistons that use Hastings ring set 665 are available from Leonard Nettles. Contact information for Leonard Nettles can be found in section 18) of this “Builders Guide”.

Modified Chevy 283 pistons that are a slipper skirt design and use Hastings ring set 665 are available from John Cosper. Contact information for John Cosper can be found in section 18) of this “Builders Guide”.

If you order special pistons, they should have a 1.906-inch compression height, a 0.000-inch wrist pin offset, and a 0.9996-inch diameter wrist pin that is centered in the piston. The new cylinder block bores are honed to 3.8754/3.8768 inches in diameter. These dimensions will be needed by the manufacturer if you order special pistons.

Ross Racing Pistons, (<http://rosspistons.com>), JE Pistons (<https://www.jepistons.com>), RaceTec (racetecpistons.com), and others can make a

custom piston to your specifications including pop-ups to raise the compression ratio. Forged pistons require additional piston/cylinder wall clearance, so if you order any special pistons, along with specifying compression height, wrist pin diameter, and wrist pin offset, specify that the cylinder bore is 3.8754/3.8768-inch diameter to avoid additional honing of the cylinder block that will remove the factory plateau honed cross-hatch finish. Our warranty does not apply to cylinder bores that have their surface finish modified.

Whatever your choice of pistons and rings, be sure to use the recommendations of clearance specified by the manufacturers or your engine builder.

For those concerned about weight, a 283 piston with wrist pin from John Cospers weighs 828 grams, a Silv-O-Lite piston with wrist pin weighs 810 grams, a piston from Snyder's or most Model A parts houses with wrist pin weighs 771 grams, a NOS Ford piston with a wrist pin weighs 730 grams, an Egge 1104 piston with a wrist pin weighs 700 grams, and a piston with wrist pin from RaceTec weighs 650 grams.

Model A engines (and the "New Engine") have the centerlines of the crankshaft and cylinders offset by 1/8 inch and the wrist pin is centered in the piston. If you choose to use modern V-8 pistons with the wrist pin offset in the piston, you may end up with too much offset resulting in high skirt loads if the pistons are installed with "front" facing forward, or not enough offset resulting in piston slap if the pistons are installed backward with "front" facing rearwards.

See section 9) Recommendations Regarding Tolerances for piston/cylinder wall clearance and ring gaps.

Rear Main Seal

We recommend that a National or SKF/Chicago Rawhide seal for a 4.000-inch shaft with an outside diameter of 5.004 inches be used so that it is a press fit into the 4.999-inch seal housing. The seal width is not important. Several different seals meeting these dimensions are available from National (Timken.com/wp-content/uploads/2020/02/National-Indust-Seals-Catalog_7707.pdf), pages 58-59, and any of them should work if properly installed.

On the "Engineering Evaluation Engine", we used a single National 415035 seal with the garter spring removed. This general-purpose nitrile seal is cheap, very common, and "off-the-shelf" from almost any bearing and seal supply house. We had no leaks or seepage. I decided to remove the garter spring that maintains lip contact because I knew that the shaft and housing were concentric, and the operating temperature would be high. The following picture shows the garter spring being removed. Our testing of the "Engineering Evaluation Engine" was extreme, and I suggest that you leave the garter spring in place.

The garter spring side of the seal needs to be installed towards the interior of the engine. The seal must be driven evenly until it bottoms out. The seal cavity is deep enough for 2 seals, but we recommend the use of one seal. If 2 seals are used, leave a cavity between the seals, and partially fill the cavity with a high-quality oil to leave an air space for the expanding oil.



A better seal is National 415035N which is made of polyacrylate and good to 300 degrees F. Even better is National 415035V which is made of Viton and good to 400 degrees F.

Other seals that will work include National 415953 which is nitrile, National 415953N which is polyacrylate, and National 415953V which is Viton.

National also makes rear main seals for Detroit Diesel series 53 engines that have the same inside and outside diameters as the 415035 seal. Detroit Diesel engines run for 100's of thousands of miles between rebuilds. National 37939 (Detroit Diesel 8926902) are made of Teflon and are identical. National 710022 (Detroit Diesel 5116229) are made of silicone and are identical.

SKF/Chicago Rawhide seals 39930, 39932, 39933, 39934, and 39935 are also suitable seals.

To ensure that the rear main bearing cap is tight against the cylinder block, the rear main seal must be installed after the crankshaft is in place and the rear main cap is torqued.

Front Main Seal

We recommend that a modern radial lip seal that is encased in a Nitrile holder be used. This seal takes the place of a packing-type seal and they are available from most Model A parts dealers. Be sure to apply a non-hardening sealant to the exterior of the seal to fill the gaps in the front cover and oil pan grooves.

Camshaft

We recommend using a new 5-bearing or reground stock 3-bearing camshaft. To prevent the build-up of oil pressure behind camshaft bearing #5 which may force the camshaft forward, we recommend that it be vented to the crankcase. Stock Model A and B camshafts have a full-length oil distribution groove at the rear bearing to provide a sufficient vent. Camshafts made by others may not have full-length grooves. If you choose to have an early Model A camshaft with 5 bearings reground, be aware that bearings 2 and 4 may be undersized from the factory.

If using a 5-bearing camshaft, the oil supply passages in camshaft bushings 2 and 4 in the cylinder block are blocked by cam bushings and need to be opened with an added hole.

The easiest and preferred method of making the holes in bushings 2 and 4 is done by removing the bushings, drilling a 1/16 (0.0625) inch diameter hole in the bushings, and then reinstalling the bushings. If a mistake is made, replacement cam bushings are available at burtzblock.com.

The hole can also be made by using a long drill and drilling from the bottom upwards. To prevent drill breakage, an aluminum plug needs to be made that fills the camshaft bearing hole (1.562-inch dia.) and supports the drill when drilling the second hole. See photos of the tools and tools in use.



If using a 3-bearing camshaft, bushings 2 and 4 do not need to be drilled, however, there is a chance of chips or grit in the blocked-off passages. To ensure that the blocked passages are clean, the bushings will need to be removed and replaced.

Please consider using our optional .340-inch lift 5-bearing camshaft that will also provide pressure lubrication to the camshaft thrust plunger. This camshaft performs a little better than a Model B camshaft with good idle and increased torque. See **13) Optional Camshaft.**

If you are using an overhead valve head or just want more power from a flathead, you need to obtain a camshaft from a cam grinder that will grind a camshaft for your application. Bill Stipe, Jim Brierley, Dimi Elgin, and Pete (on FordBarn) are all capable of grinding camshafts. You will need to specify your rocker arm ratio, compression ratio, carburation, other modifications, and intended usage.

The following website has a good explanation of camshafts:

<https://www.tildentechnologies.com/index.html>

Camshaft Gear

We recommend that an aluminum camshaft gear with a deepened dimple be used for ease of ignition timing. A bronze gear can be used, but it is expensive and adds inertia.

When the camshaft gear is installed on the front of the camshaft, ensure that the 2 dowel pins are recessed. If they protrude, the camshaft nut will bottom out on the dowel pins instead of the gear.

Dan McEachern makes the most accurate timing gears. Dan's contact information can be found in section 18) of this "Builders Guide".

Valves

Two-piece original, one-piece with shoulder or press-in valve guides with appropriate valves can be used. If press-in guides are driven in crooked, there is a chance of fracturing the cylinder block and that is not covered by our warranty. Some press-in guides have a slightly larger diameter on the top end. If these are used, they must be removed by pulling from the top with a slide hammer. If they are driven into the valve chamber for removal, there is a chance of fracturing the cylinder block and this is not covered by our warranty. We like Snyder's Modern valve set (Part number A-6505-M) that has slip-in guides with a shoulder.

To verify that the valve seat is concentric with the valve guide, make sure that the cylinder block is vertical and then drop a valve through the guide. If it bounces, everything is concentric. If it doesn't bounce, something is not concentric.

We recommend that the valves be lapped using Permatex 80036 Valve Grinding Compound. Before lapping, apply Toolmaker's Layout Ink or permanent marker ink to each valve and seat face. When lapping, only rotate the valve a few degrees. Lapping is only needed to remove the toolmaker's ink and ensure proper seat width and location. After lapping, remove the lapping compound with a clean rag and inspect the valve face. The lapped area should be continuous around the entire valve face, the width of the lapped area should be 0.077 inches, and the lapped area should be centered on the valve face. The following picture shows what the contact area should look like.



Oversized intake valves can be used; however, they may not help performance because the head of oversized valves comes very close to the combustion chamber

wall in the head creating a restriction. Our warranty does not apply to any machine work needed for oversized valves.

The thickness of the upper surface of the new cylinder block and the original cylinder block are identical at $3/8$ (0.375) inch. The ports can be smoothed, but the walls are only $5/32$ (0.156) inches thick, and the removal of excess material is not warranted.

If you wish to extend exhaust valve life, consider using valve rotators. Valve rotators rotate the valve slightly during each cycle and are used on engines subject to high loads like performance Corvettes or truck engines. Valve rotators take the place of modern valve spring retainers and are compatible with Snyder's Modern valve set (Part number A-6505-M). The part number for valve rotators is GM 14042575, SBI 161-1012, or Federal Mogul RC157S.

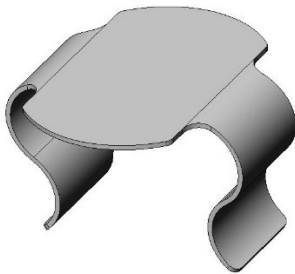
Oil Deflectors

There have been a few reports of oil in the intake ports. Oil flung off the connecting rods can come up through the 4 drain holes at the bottom of the valve chamber. To keep the flung oil away from the intake valve stems, oil deflectors can be made that will snap into the 4 holes.

A homemade deflector can be made from the clip (spring) of a 1002 800 049 Home Depot Roller Catch, a washer, and a rivet. The roller catch and assembled deflector are shown in the pictures below. I want to thank Bob Meneely for his design of the cupboard catch deflector design.



We are working on having a 1-piece deflector made. The SolidWorks design of a 1-piece deflector is shown in the following picture.



Tappets

We recommend that "single lock" Colony CM102-8 tappets be used for flathead applications. For OHV applications where the adjustment is at the rocker arms, stock Model A or Model B tappets can be used.

For flathead engines, it is much easier to rotate the camshaft and adjust tappet clearance before the pistons and rings are installed.

Head

Many aftermarket high-compression flatheads have a reputation for not being flat.

Head gaskets are expensive and Plastigage is cheap.

If you have an aftermarket head with doubtful flatness, oiled Plastigage should be used to verify cylinder head flatness before wasting a head gasket and having to spend the time to clean the resulting mess from a failed head gasket.

Place short pieces of oiled Plastigage around various locations on the cylinder block, install the questionable head, and tighten the nuts to 20 lb-ft in increments not exceeding 5 lb-ft as described in “Head Torque” below.

Remove the head and measure the Plastigage. If your head is not within 0.002 inch of being flat, we recommend that it be resurfaced, or you can use a Best 509C head gasket that is more tolerant of flatness.

For a stock-appearing head with a compression ratio of 6.5 to 1 that is flat and will pass fine point judging, please consider using our optional head. See **14) Optional Head.**

Head Gaskets

We recommend Best Gasket Co. brand head gaskets.

If your head is not flat, we recommend using the Best 509C head gasket. The Best 509C head gasket compresses from 0.080 inches to 0.052 inches (0.028 inches) during the application of torque and will likely work with heads that are not flat. We recommend a light coat of Permatex 80697 Copper Spray-A-Gasket on both sides of the gasket just before assembly.

If your head is flat, or using our new head, we recommend using the Best 509G head gasket. The Best 509G head gasket compresses from 0.058 inches to 0.055 inches (0.003 inches) during the application of torque and will work with heads that are flat. We recommend a light coat of Permatex 80064 Copper Spray-A-Gasket on both sides of the gasket just before assembly.

Retail parts dealers assign their own numbers for the Best Gasket Co. gaskets, so you will need to make a phone call to get the gasket that you choose to use.

We used a Best 509G graphite gasket on the engineering evaluation engine without any sealant, and it did not need to be retorqued after testing.

On the engineering evaluation engine, we used Permatex Black Gasket Maker 27037 sealant instead of a gasket at the water outlet to prevent breakage of the outlet ears when the nuts were torqued to 55 lb-ft.

Do not alter the surface finish on the top of the cylinder block. It has a surface roughness needed to grip the head gasket. Our warranty does not apply to cylinder blocks that have had their surface finish altered.

If you have any concerns about head gasket sealing or the integrity of your existing head, we recommend using Irontite “Ceramic Motor Seal” for new engines using water, or Irontite “All Weather Seal” for engines that are using antifreeze coolant.

Head Torque

Head and cylinder block cracks between the stud holes and the water jacket at the center of the engine on original or aftermarket Model A Ford heads are caused by engine builders that use cushy (clad) head gaskets and start in the center of the head to apply torque in large increments.

Apply head torque in increments no larger than 10 lb-ft. Larger torque increments can crack the head or cylinder block at the center, especially when using a clad head gasket with a soft core that has a lot of deflection during the application of torque. The Best 509C (clad) gasket compresses from 0.080 to 0.052 inches during the application of torque, and the Best 509G (graphite) compresses from 0.058 to 0.055 inches during the application of torque.

Instead of torquing in a spiral from the center of the head outwards, there is less chance of cracking a head if you start at the rear and work forward.

Cast iron heads need no more than 55 lb-ft of torque. Torque for aluminum heads is dependent on the thickness of the head because aluminum expands more than

twice what cast iron expands for the same temperature change and you need to ask your head supplier for a recommended torque value.

When retorquing a head gasket, torque one nut at a time as follows: loosen the nut 45 degrees (1/8 turn) and then tighten to 55 lb-ft.

Oil Pan

The upper surface of an original oil pan is often distorted due to over-tightening with the thick cork gasket and may need to be straightened. Dipper trays and the pan can also be distorted by improper removal of the dipper tray. The dipper tray is easily removed with a 2 x 4 and a woodworker clamp. Place the 2 x 4 across the middle of the pan and use a woodworker clamp that reaches through the oil pump opening to grab the underside of the dipper tray and the top of the 2 x 4. Close the clamp and the dipper tray will pop out without damage.

Dipper Tray

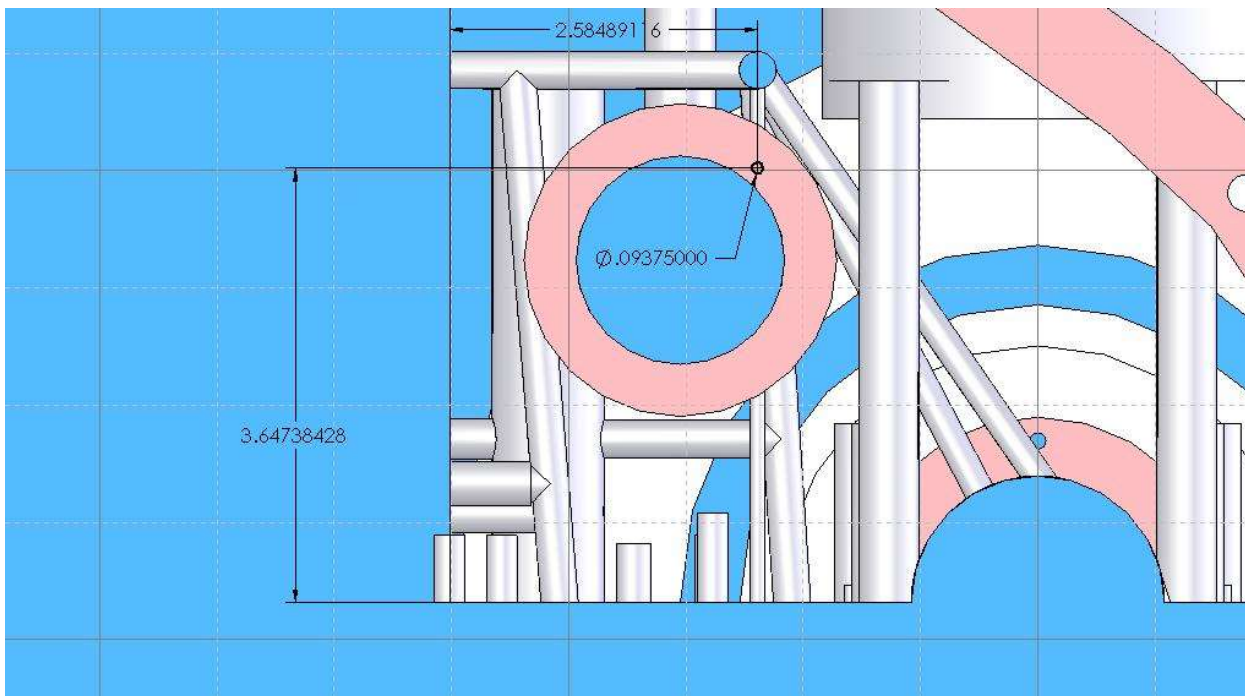
We recommend leaving the unmodified dipper tray in place because the baffles on the bottom help to mitigate oil sloshing and starving the oil pump. The new connecting rods have reinforcing ridges that dip into the troughs on the upper side of the tray and this creates an oil mist to lubricate the wrist pins, cylinder walls, valve guides, tappets, and timing gears.

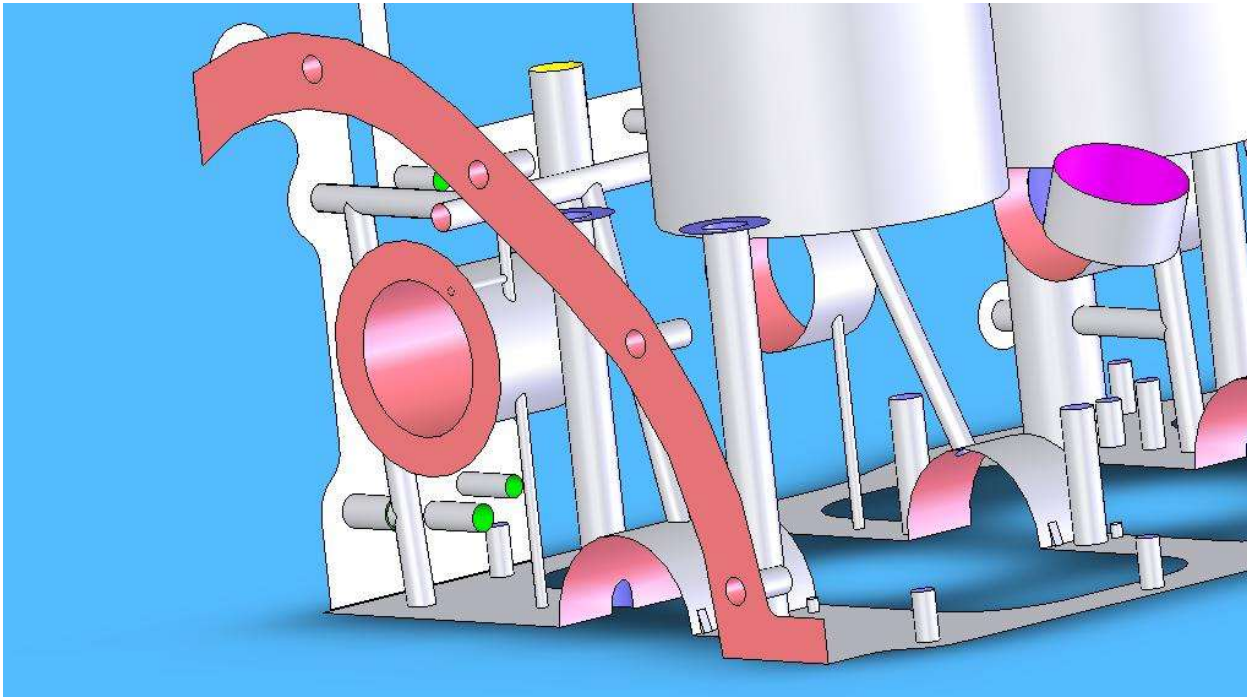
The very early 1928 dipper trays have slots instead of wells and there is a good chance that the connecting rods will hit the dipper tray.

Before installing the oil pan with the dipper tray, turn the engine upside down and without a pan gasket, place the pan in place, and loosely install 4 pan bolts. Rotate the crankshaft and look for any movement of the pan which is an indication that the connecting rods are contacting the dipper tray.

Camshaft Thrust Bearing (1st Production Run)

The "Engineering Evaluation Engine" and the 1st production run of "New Engine Kits" did not provide pressurized oil to the camshaft thrust bearing. There have been no problems, but we recommend that a hole be drilled to supply pressurized oil to the camshaft thrust bearing. This hole will be on the 2nd production run and connects the thrust surface of the camshaft to the oil passage that supplies pressurized oil to the front cam bearing. The hole is 3/32-inch diameter and located as shown in the following figures. The dimensions shown are from SolidWorks, but a tolerance of +/- .015 inch is acceptable. If using a handheld drill motor, consider using a drill press to make a drill guide from a piece of scrap metal and clamp it in place to guide the drill and keep it perpendicular.





Camshaft Bushings (1st Production Run)

On the 1st production run, the center cam bushings may be too wide and interfere with the distributor drive gear. The bushings can be driven fore and aft to clear the gear or the bushings can be relieved with a notch. The 2nd and succeeding production runs have narrower cam bushings.

Studs

We recommend that grade 8 head studs be used and installed using Permatex 80078 anti-seize compound where the studs thread into the cylinder block. These studs are strong and less likely to twist off during removal in a future rebuild.

8) Cleanliness

Light oil was applied to the new engine kit parts to prevent corrosion, and it has likely collected a lot of dust particles during transportation. In addition, every oil

passage, threaded hole, and blind dowel pin hole may have machining chips and grit that need to be removed. Additional chips and grit were created during the deburring process.

Remove the 4 setscrew plugs in the crankshaft to open all passages for cleaning.

For a long engine life, every part (new or old) needs to be surgically cleaned.

Cleanliness is very important on surfaces where sealants or epoxies are used, and these surfaces need to be cleaned with acetone for proper adhesion.

If you are building the new engine in a home shop without the proper cleaning equipment, we recommend that you deburr all parts, and then take your parts to a shop that has a spray wash cabinet with a turntable, heated water, detergent, and high-pressure spray nozzles for proper cleaning. Do not let the shop use any solution that may damage the cam bushings.

9) Recommendations Regarding Tolerance

We recommend that you follow the dimensional specifications from your parts suppliers or engine builders. If specifications are not available, then use these recommendations.

Upper ring gap 0.013 to 0.020 inch

Middle ring gap 0.012 - 0.020 inch

Lower ring gap 0.010 - 0.020 inch

Piston-to-cylinder wall clearance measured at the bottom of the piston at 90 degrees to the wrist pin 0.004-0.0045 inch if using solid skirt cast pistons, 0.002-0.003 inch if using split skirt cast pistons, 0.007-0.008 inch if using forged pistons.

Forged pistons are made to order. Have them made undersize so you do not have to hone the cylinder block. The cylinders are plateau honed, and additional honing is not warranted.

Intake valve/Tappet clearance 0.011-0.012 inch

Exhaust valve/Tappet clearance 0.012-0.013 inch

Main and Connecting Rod bearing clearance 0.002 inch is ideal, 0.0010 - 0.0035 inch is acceptable (per the Clevite catalog)
Crankshaft end play 0.002-0.007 inch

10) Recommendations Regarding Fastener Torque

The following torque values assume that the threads are clean, free-running, and not lubricated with wax or something else that will reduce friction.

Please use common sense and be cautious of using the torque values published in recent literature.

Torque values were not specified in the Model A era. Instead, special 5-Z tools were made, and the length of the wrench handle was used to determine the torque applied. The original tool kit contained a wrench (A-17017) for the spark plugs and cylinder head nuts. A normal person using this wrench can apply around 55 lb-ft of torque. Mechanics at Ford dealers used wrench 5-Z-1901 that had a similar length handle.

Head

We recommend a head torque of 55 lb-ft applied as described under “Head” in section 7) Recommendations Regarding Add-on Parts. If you are using a Best 509C or other head gasket that compresses a lot while torquing, please torque all nuts evenly in small increments to lessen bending loads that may result in a crack.

Main Bearings

We recommend the main bearing nut torque to be 55 lb-ft.

Connecting Rods

We recommend a connecting rod bolt torque of 40/45 lb-ft. A thin-wall 12-point deep socket may be needed (Craftsman 43301 or equivalent).

Manifolds

We recommend a manifold nut torque of 30 lb-ft, either starting at the center and spiraling out or end to end in 5 lb-ft increments.

Camshaft Nut

We recommend a camshaft nut torque of 50 lb-ft with Blue Loctite Threadlocker.

Crankshaft Ratchet Nut

We recommend a crankshaft ratchet nut torque of 70 lb-ft.

Flywheel Attachment Bolts

Instead of using the original 7/16 UNF x 13/16-inch-long flywheel attachment bolts, we recommend 7/16 UNF x 1.25-inch-long Grade 8 bolts with a torque of 55 lb-ft. If different than stock bolts are used, ensure that the bolt head height won't interfere with the clutch disk.

Pressure Plate Attachment Bolts

We recommend a torque of 18 lb-ft.

11) Recommendations Before Starting Engine

We recommend that the spark plugs be removed, and the newly assembled engine be cranked by the starter to confirm oil pressure.

If the choice is made to use an oil filter, we recommend that the filter be filled before assembly.

12) Optional Flywheel

The optional 30-pound flywheel is machined to use the Ford V-8 9-inch Long design pressure plate (48-7563 or 09A-7563) and is balanced. We do not recommend the use of the 8N-7563 tractor pressure plate that does not have flyweights and the 3 fingers are not adjustable.

If using a rebuilt or old pressure plate, make sure that the pressure plate is balanced separately from the flywheel. If the new already balanced flywheel is needed as a holding fixture to balance the pressure plate, insist that the shop doing

the balancing only take material from the pressure plate to obtain balance. There are iron bosses inside the pressure plate springs that can be drilled to remove material.

When the flywheel and pressure plate are balanced separately, there is no need for match marks, and the pressure plate can be assembled in any orientation.

New 09A-7563 pressure plates with flyweights and adjustable fingers are available for \$107.95 from Bratton's under part number 11460 and are balanced correctly. The figures below show the differences between the 09A-7563 and 8N-7563 (tractor) pressure plates.



Ford 09A-7563, Bratton's 11460



8N-7563

The new flywheel is machined to accept the original Ford shoulder bolts (350433-S, 5/16-18 UNC x .77 inch long with a shoulder length of .375 inches) that attach the pressure plate to the flywheel. These bolts were used from 1935 through 1960. Shoulder bolts are much stronger in shear than fully threaded bolts and use lock washers. Equivalent bolts include www.thirdgenauto.com part number R-692 and www.just8ns.com part number 350433-S. Pioneer S-1121 is advertised as an

equivalent, but the shoulder is too short. ARP 150-2201 bolts are advertised as an equivalent, but they are .25 inches too long and are used on 1961 and later Ford products. The ARP bolts will work if the threads are shortened or the threads in the flywheel are deepened.

The new flywheel does not come with a ring gear installed because the beveled teeth on the ring gear need to be at the rear if using a Model A starter, and at the front if using a gear reduction starter.

We do not recommend the use of a modern "barrel" tractor starter drive instead of an original Bendix because the "barrel" drive has a shorter throw (the distance that the pinion gear moves between rest and extension), and it will not engage the ring gear teeth completely.

The new flywheel does not come with a pilot bearing because some people prefer the porous bronze oil-impregnated bushing while others prefer a ball bearing.

When installing any flywheel to the new crankshaft, it is recommended to use 2, 7/16-20 UNF bolts with their heads cut off as guide pins to get the flywheel/dowel pin holes started squarely.

13) Optional Camshaft

The new 5-bearing camshaft has a 0.340-inch valve lift, the intake and exhaust lobes are separated by 113 degrees, and the duration is 248 crankshaft degrees from when the valve just starts to open to when it closes. Tappet clearance will reduce the above numbers.

The new camshaft is made from nodular iron which is the material of choice and used in nearly all new production engines.

The lobes are induction hardened to Rc 58/62 to minimize wear, and the 5 bearings and center gear are hardened to Rc 40/52 to keep the gear teeth from becoming brittle.

The depth of hardening on the lobes of the new camshaft will allow regrinding for overhead valves or a more aggressive flathead grind.

The new camshaft has passages that will supply pressurized oil to the plunger at the front of the camshaft and if the new camshaft is used with our “New Engine Kit”, there will be 17 pressure-fed bearings instead of 16.

The hole in the front of the camshaft to lube the plunger needed to be 4.5 mm (0.177 inch) in diameter to prevent drill breakage. If the plunger (A-6275) face has deep cross-grooves, or if the oil pump cannot supply adequate volume, oil leakage can be reduced by inserting a 4 mm x 20 mm long dowel pin (McMaster Carr 97049A332) in the 4.5 mm hole. If you have any doubts about oil pump volume or leakage at the deep cross grooves in the plunger, install the dowel pin.

Ford drawing A-6250 was used for all interfacing dimensions.

The new camshaft can also be used in all Model A, Model B, Russian GAZ, and German G28T engines. If used in Model B, Russian GAZ, and German G28T engines, bearing number 2 could be ground and hardened to make a fuel pump lobe.

14) Optional Head

Our new head has a compression ratio of 6.5 to 1.

Our head looks original because the exterior of an original head made during production was laser scanned to capture every little detail and is the basis of the exterior.

Draft, parting lines, core wire support bosses, foundry identification marks, and many other details not found on Ford drawing A-6050 have been documented with the laser scan.

Original heads have foundry marks to identify the source for quality control. The foundry mark is a raised protrusion located on the head between the water pump's machined surface and the machined surface for the water outlet. Known foundry marks include a delta (triangle), a straight line, or a diagonal line.

Later heads sold over the counter by Ford dealers and all aftermarket heads have an exterior appearance that will not pass fine point judging.

The machining details are identical to Ford drawing A-6050, and if the new head is placed on a surface plate, a 0.003-inch feeler gauge should not be able to be inserted between the head and the surface plate.

The combustion chamber is a modified A-6050-B “Police Head” that has a volume of 140 cc to increase the compression ratio.

The new head directs more cooling water to the rear to help cool exhaust valves #3 and #4.

The new head has 4 blind holes for the water pump attachment which eliminates a potential leakage path.

All interfaces agree with Ford drawing A-6050, so the new head will fit any Model A, Model B, Russian GAZ, or German G28T engine.

We received 2 new heads to evaluate. The first new head was dimensionally and cosmetically verified by me, and I found 3 small cosmetic defects that have been corrected. After verification, I cut the new head into several pieces to verify wall thickness and the results were good.

Dennis Kliesen did a performance evaluation on the second new head and the results were that the revised water passage holes provided more cool water to the rear of the cylinder block resulting in a more even temperature, and Dennis was happy with the added performance when he drove from California to the 2022 MAFCA National Convention in Kerrville, Texas where daytime temperatures exceeded 100 degrees Fahrenheit.

15) Detailing the New Engine for Judging

Steve Plucker has documented the evolution of the Model A cylinder block. Steve's extensive documentation can be found here:

http://www.plucks329s.org/pdf/engineblock/cylinder%20block%20guide_1.pdf

The main oil galley in the new cylinder block is very long and had to be drilled from both the front and rear of the cylinder block. The front drilling and plug are internal and hidden. The rear drilling and plug are between the cylinder block and flywheel housing and are very hard to see, but if the cylinder block is to be used in judging, the depression should be filled with a high-temperature epoxy and textured to appear like cast iron. Heat will soften the epoxy if you ever want to remove the set screw plug. Place a small wad of paper in the hex socket of the setscrew plug before applying the epoxy to make it easier to remove the plug at a later date.

The serial number pad may need shortening. (Engines before Feb 1929). If shortened, the “Cast iron texture” can be recreated with a needle scaler from Harbor Freight. The serial number is hand-stamped (Numbers are slightly crooked and spacing is uneven) across the **top** of the pad. Stamps with the correct font are available at <https://restostamps.com/collections>. Note the serial number location and crookedness in the following picture. Lay the cylinder block on its side and stamp the serial number with a short handle sledgehammer. Hit each stamp one time and hard enough to avoid double stamping. Practice stamping on a scrap cylinder block.

The small external bump near the camshaft bearing number 5 may need to be removed. (Engines before April 22, 1929) After removal, the surface can be retextured with a needle scaler.

Grind marks on the exterior of the water jacket need to be made. These marks are between cylinders 1 and 2, and 3 and 4 where water jacket core support wires exited the cylinder block. Look at an original cylinder block for the locations, texture, and direction of the grinding grooves. The next photo shows one that was ground very poorly or was possibly plugged but provides location. The edge of a coarse (16 Grit) grinding disc or cutoff wheel works best to get the proper texture.

Original cylinder blocks were painted before the machining and stamping of the serial number. The serial number and all visible machined surfaces should be bare cast iron.



The new head has 3 bumps on the upper surface where core support wires exited. These bumps were ground at the factory and need to be ground with the edge of a coarse grinding disc or cutoff wheel. Do not use the face of the disc because it will create a smooth surface. Look at an original head if possible, to see the desired texture and direction of the grinding grooves.

16) Project History, Design Details, Pictures, and Videos

This project started in 2007, stalled in May 2015, and was resurrected in July 2019.

Design details, updates (progress reports), pictures, and videos can be found here: <http://www.modelaengine.com>

17) Web Resources

There have been a lot of questions asked and answered along with comments and opinions on social media.

FordBarn: <https://www.fordbarn.com/forum/showthread.php?t=265782>

VintageFordForum: <https://www.vintagefordforum.com/forum/model-a/188084-new-model-a-engine>

Facebook Group: “The Burtz Ford Model A Engine”
<https://www.facebook.com/groups/1123377268114692> This link has lots of pictures, videos, and comments from people building the “New Engine” and is simply a great source of reference material.

Google search is a wealth of knowledge. Search “Burtz engine”. Ask it questions like: "What piston is best for my engine?", "Are thin piston rings better than thick?", "What is a tri-metal bearing?", "What motor oil should I use?", How to build a Small Block Engine, etc.

18) Education, Resources, and Making a Decision

Please take the time necessary to educate yourself so you can plan and make a decision regarding what you want your new engine to look like and how you want it to perform.

The following is a list of literature that you may want to read.

Restoration Guidelines and Judging Standards

https://mafca.com/pub_standards.html

Model A Ford Mechanics Handbook Vol. 1, Les Andrews

<https://www.amazon.com/Model-Ford-mechanics-handbook-Andrews/dp/0965824004>

4-bangers And me, Jim Brierley (Self-published book, do a Google search),
jimb4e4@gmail.com

Secrets of Speed Society <http://www.secretsofspeed.com/>

Model “A” and “AA” Parts Price List, Ford Motor Company, a list of chassis and drive train parts with original Ford part numbers.

The following is a partial list of suppliers that provide both stock and performance parts or can build your new engine. If I need to add someone to the list, please let me know.

Snyder's, New Springfield, OH, (<https://www.snydersantiqueauto.com/>)

Bratton's, Mount Airy, MD, (<https://www.brattons.com/>)

Bert's, Englewood, CO, (<https://modelastore.com/>)

Dave Delmue, Morgan Hill, CA dave4564@msn.com, (408) 722-2518

Chris Wickersham [626-405-9798](tel:626-405-9798), wcwickersham@earthlink.net

Leonard Nettles, Tustin, CA, (<https://www.dadsvintageautoparts.com/>)

Brian Weber, Santa Maria Tool Inc, Santa María, CA, (805) 925-2126

Prus Engine and Machine, Columbiana, OH, Kevin Prus (330) 774-7130

Model A Medic, Wichita, KS, Eric Weninger, (www.modelamedic.com)

Schwalms, Strasburg, PA, (schwalms.com), Ora Landis (717) 687-6976

Randall Strickland, Lamsburg, VA (276) 733-2628

A.E.R., Brian Behning, Bluffton, IN, (<https://www.antiqueenginerebuilding.com/>)

Ron's Machine Shop, Shandon, OH, BJ, <http://ronsmachineshop.com/Home.html>

Vilas Motor Works, Bryan, TX (979 775-1633) <https://www.vilasmotorworks.net/>

Taylor Made Motors, New Braunfels, TX (taylormademotors.com) 830 660-8094

Hanford Auto Supply, Hanford, CA, Timmy McMaster (559) 584-4487

Tebo's Barn, Milton, NH, Ryan, (603) 534-2950, tebobarn@gmail.com

Parks Engine Service Inc, TX 830 379-4562 (<https://www.parksenigne.com/>)

Durable Performance, Jordan, MN, Dave Gerold, (www.durableperformance.net)

H & H Antique, La Crescenta, Ca, (<http://www.handhantique.com/>)

Joe Silvis, Turlock Machine, CA, (chipmakerjoe@yahoo.com) (209) 495-1689

Ken Davis, Colleyville, TX (modelamaniac@sbcglobal.net), (817) 540-1513

Model A Garage, John Phillips, Luray, VA, (www.modelagarage.com)

Dennis Kliesen, Mission Viejo, CA, (drkliesen@gmail.com), (949) 466-7475

Gaslight Auto Parts, Urbana, OH, (<http://www.gaslightauto.com/>)

Mike's A Fordable, Maysville, GA, (<https://www.mikes-afordable.com/>)

Arizona Model A LLC, Chandler, AZ, (<http://arizonamodela.com/>)

C W Moss, Orange, CA, (<https://cwmosss.com/>)

Dimi Elgin Camshafts, Santa Rosa, CA, (707) 545-6115, dima@elgincams.com

Dan Price, Galena, OH, (<https://www.dan4banger.com/>)

Charlie Yapp, Batavia, OH, (<https://www.secretsofspeed.com/speed-parts>)

Steve Serr, Ventura, CA, (<https://www.millerhi-speedheads.com/>)

Bill Stipe, Plymouth, WI, (<https://www.specialtymotorcams.com/>)

FSI Ignitions (<http://www.fsignitions.com/>)

Petronix Ignition (<https://pertronix.com/>)

Red's Headers, Chiriaco Summit, CA (<http://www.reds-headers.com/>)

Nu-Rex (<https://www.nurex.com/>)

Jim Brierly, Temecula, CA, camshaft regrinding, (jimb4e4@gmail.com)

Piranios, Denton, TX, Dyno sheets (<http://www.modelaparts.net/>)

Dan McEachern, Alameda, CA, (dmcgears@yahoo.com) (510) 769-7524

John Cosper, NM, pistons, (505) 440-1280

Larry Gesch, Lowell, WI, Country Motors, LTD, (414) 305-2358

Eckman Auto, Rexburg, ID (www.eckmanperformance.com) 208 356-4724

Yesteryear Garage and Parts, AU (www.yesteryearparts.com.au)

Kyte Engines, Sun Valley QLD 4680, AU, Lawrie (07)49 786 339

Meka Classic Engine Parts, NL (www.mekaengineparts.com)

Around the Block Engines, CA (aroundtheblockengines.ca)

Dean Roberts, AU (dean@visionsafe.com.au)

On the Piranios website (<http://www.modelaparts.net/>), you will find many dynamometer results for a variety of parts combinations. Please use these results to decide what you want to build and how you want your new engine to perform.

19) Replacement Parts

The design of the new engine Cylinder Block, Crankshaft, and Connecting Rods has incorporated parts that are readily available from several sources.

If one of your new engine parts gets lost or damaged, replacement parts are available.

Except for studs, all fasteners and small parts are available from McMaster Carr or other vendors. The part numbers are called out at the beginning of this “Builders Guide”.

Bearing inserts and seals are available from Jegs, Speedway Motors, O'Reilly's, NAPA, Rock Auto, eBay, Amazon, and your local auto parts store.

We have the adjustable analog oil pump relief valve, the front and rear main seals, and the special bolts needed for an oil filter and to measure the main oil galley pressure. Please see www.burtzblock.com.

We have spare parts. If you need a cylinder block assembly, crankshaft, studs, a set of connecting rods, or camshaft bushings, please contact us at www.burtzblock.com.

If you are building an engine for racing where an original cylinder block is a requirement, our crankshaft and connecting rods can be ordered separately and an original cylinder block can be modified to accept the 5, 2-inch diameter main bearings.

For rebuilds in the future, the Clevite CB-745P or Federal Mogul 2020 CP bearings are available .001, .002, .010, .020, .030, and .040 inch undersize, and if the housing bore gets damaged, they are available with a housing bore larger by .002-inch diameter.

The exhaust valve seat is dimensionally identical to MAHLE 218-7535 and oversizes are available if needed in a future rebuild.

20) Contact Information

Terry Burtz, (model.a.engine@hotmail.com) Engineering and anything technical including presentations, answering questions, and revisions to the “Guides” (Builders Guide, Doubling the Flow Area of a Model A Oil Pump, and Installing an Oil Filter).

John Lampl, (jrlampl@jrlasia.com) Manufacturing, Quality Assurance, Sales, Shipping, and Distribution.

William Percival, (wrpercival@gmail.com) Business Management and Bookkeeping

If you don't know who to contact, contact any of us and we will figure it out.

21) Liability and Guarantee

ALLIED CLASSIC INC., warrants this product for one year to the original purchaser from the date of purchase. If the product is used for racing or competition or has been modified in any way, the warranty is limited to manufacturing defects only; wear and breakage are not covered under any circumstances. If the product shows, in our opinion, evidence of being used or installed contrary to the instructions and/or subjected to improper handling, packaging, or shipping by the customer, it will not be covered by our limited warranty. The liability to Allied Classic for losses or damages arising out of any cause whatsoever is limited to repair or replacement, at our option only. Allied Classic will not be liable for any consequential or incidental damages. Some states do not allow the exclusion or limitation of consequential or incidental damages, so the above limitation or exclusion may not apply to you.

The new Model A engine kit and flywheel are designed to be replacement parts for the original frail parts and are only to be used in automobiles that are licensed and used on public streets and highways at legal speeds. The new parts are not intended to be used in airplanes, racing, off-road, endurance trials, or in any other high-speed contest or application. We accept no liability and there is no guarantee for parts that fail from mis-installation, modification, or misuse.

We guarantee that the "New Engine Kit" and optional parts when shipped are in pristine condition.

We are not liable for shipping damage.

If you receive a shipment that is damaged, take photographs of the damage before acceptance and note the damages on the receiving document that you sign when receiving the shipment. If there is shipping damage, you need to file a claim with the shipping company.

22) Unwarranted Modifications

The following modifications are not covered by any guarantee, and we do not endorse the use of the new engine in an airplane, race car, or any application other than motor vehicles that are insured, licensed, and used on public streets and highways at legal speeds.

If you are going to use the “New Engine Kit” in an airplane, the upper rear thrust bearing in the cylinder block needs to be moved to the front of the rear main to provide a 360-degree thrust bearing for the propeller, and the rear main cap needs to be modified to provide more oil flow to the forward thrust bearing by drilling a new passage and plugging the passage that supplies oil to the rear thrust bearing. This modification provides pressurized oil to the thrust bearing that is under continuous load from the propeller.

Weight and inertia are important in race cars and airplanes. The new crankshaft with 5, 2.000-inch diameter main and connecting rod bearings is much stiffer than a stock crankshaft with 3, 1.625-inch diameter main bearings and 4, 1.500-inch diameter connecting rod bearings. To reduce weight and inertia, the counterweights on the new crankshaft could be reduced and machined to use Mallory 3000, an alloy that is mostly tungsten and heavier than lead.

Additional weight can be removed from many areas of the cylinder block by using a die grinder.

Instead of having crankcase mist lubricate the tappets, oil pressure can be supplied to the tappets by drilling from the valve chamber. Drill through both tappet walls and into the main oil galley. An aluminum plug in the tappet hole may be needed for a drill guide for the 2nd hole into the main oil galley.

Instead of having crankcase mist lubricate the camshaft lobes and the bottom of the tappets, a special camshaft could be made. This special camshaft would be drilled to have a full-length oil passage and have small holes in the heel of the

lobes. Pressurized oil would then be supplied through camshaft bearings #1, #2, #4, and #5 to the full-length passage and deliver oil to the lobes.

A supercharger for more performance is available for Model A engines and can be found at <https://frenzelsuperchargers.com/products> Arron Loveless (831-233-0787)

Overhead valve heads are available from:

Charlie Yapp, (<https://www.secretsofspeed.com/speed-parts>)

Dan Price, (<https://www.dan4banger.com/>)

Steve Serr (<https://www.millerhi-speedheads.com/>)

Country Motors Ltd (920) 349-8100, cmtr98@yahoo.com

Joe Silvis, Turlock Machine, (chipmakerjoe@yahoo.com)

H & H Antique (<http://www.handhantique.com/>)

23) Cottage Industries

Although the “New Model A Engine” is made in “state of the art” factories in China, it is still a cottage industry with 3 people (John Lampl, Bill Percival, and Terry Burtz) involved who live in the USA.

We are pleased that the “New Model A Engine” has caused an increase in sales for those cottage industries that manufacture aftermarket parts (Carburetors, Manifolds, Headers, Distributors, Superchargers, High Compression Heads, OHV Heads, and many other parts) for increased performance and ease of driving.

We are especially happy to see individuals who have designed and are making parts for the new engine. These people include Leonard Nettles (Oil Pumps, Oil Filter Housing, and Valve Cover), Dennis Kliesen (Combination Oil Filter Housing and External Oil Pressure Relief Valve), Dan Price (Oil Pump), Joe Silvis (Oil Pump), and Timmy McMaster (Modified V-8 Oil Pump).

