Technical Tips from Three Experts on Rebuilding the HV-12 Engine
Transcribed by Shirley Hopkins

The HV-12 Rebuilding Bible

By Jake Fleming

This article was published as a series in The Way of the Zephyr in the 1980s. It is valuable information so I am typing it out for our members. It will be word for word except for things such as which part in the series it is. I am taking it off of the photocopied pages we used to rebuild our HV-12 perhaps 20 to 25 years ago. There are so many good tips on rebuilding and maintaining the HV-12 in The Way of the Zephyr that I recommend you try to get hold of a complete set of the magazine. Lacking that, purchase as many of the issues that you can get from this Website.
- Shirley Hopkins, February, 2018

Jake will take us through the complete rebuild of the HV-12 engine, with the aim of making all the improvements necessary to make it a strong, reliable, and long-lasting engine.

It is hoped that it will inspire you to get busy on your own V-12 mill, and we feel that there is nothing here that cannot be accomplished by the average owner, assisted by machine shop services where they are necessary.

For those of you who lack either the skill or confidence to do it yourself, these articles will assist you by making you knowledgeable about the processes and improvements, so that you will be able to intelligently specify and direct the work of your mechanic. Whatever the case may be, the end result will be a roadable car that you can drive and be proud of. (You will not have to take a back seat, nor eat anyone's dust…Tech. Ed.)

The HV-12 is a much-criticized and misunderstood engine. During its twelve-year life span it was not acclaimed as a great engine, due to its seeming lack of longevity. Many were evicted from their cars for almost any other type that could be made to fit. Yet some praised this engine as a very good one. Sidney Allard used it in his Allard sports cars, and Les Keeton drove race care powered with an HV-12.

This engine, when right, is incredibly smooth and quiet, especially in the hydraulic lifter models. Also, when tuned correctly, it will start when the first piston in firing order comes up for compression.

We begin with the basic block. We have the 1936-37 267 CID, 1938-41 292 CID, big block 1942 305 CID, and the last size from 1946 through 1948 was 292 CID. You may want to rebuild your own block, or buy any block you can get for rebuild. You would think the 1942, being the biggest, would be best, but when the larger bore block is re-bored the casting sometimes gets too thin. This is mainly why Ford went back to 292 CID in mid 1946, and kept the block at this size through 1948. Probably the best blocks will be the 292s of the post war period, if you have any choice.

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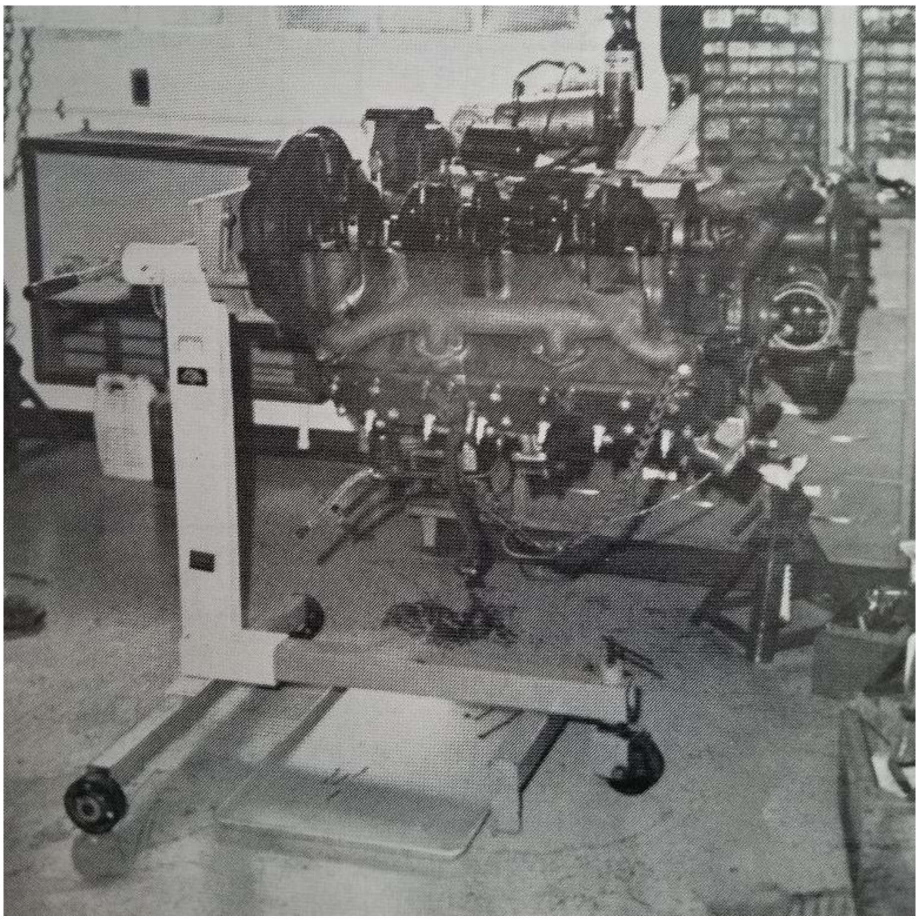
Here are a few tips on disassembly of the block before cleanup. Probably the hardest job is getting the valves and guides out. If you do not intend to reuse the old valves, and I doubt you will, the best way is to break the valve head off the stem. Try to turn the crankshaft so the valve is open, strike the valve head with a hammer, and the head will break off. Then take a short piece of pipe, fit is over the valve stem, and drive the valve guide down enough to remove the horseshoe keeper. Soaking the guide with penetrating oil beforehand will help. Then pry the guide up and down until it pops out the top of the block. If you do not use the break method, you have to use a valve pry bar or other spring tool hooked into the bottom groove of the guide to lower it enough in the block to remove the keeper. This method would be used on a repair job or replacement of a lifter. The remaining disassembly such as pistons, cam, etc. is about like any Ford V-8 or similar engine.



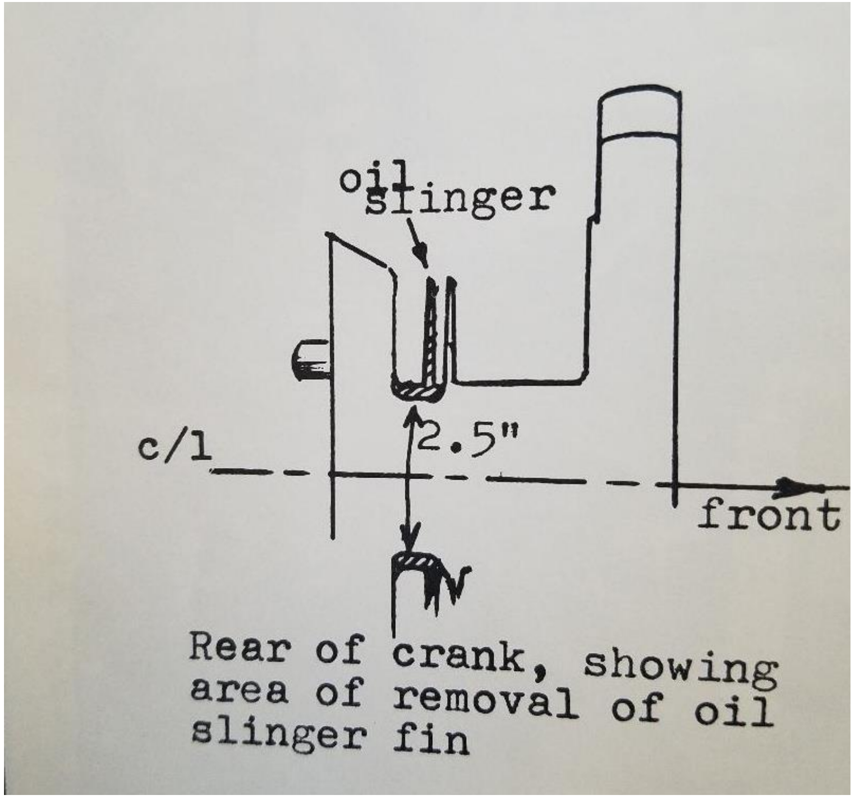
A good engine stand is a joy forever. This is an Owatonna.

Thoroughly clean the block, including removing the water freeze plugs to get to the water passages. After cleanup, check for cracks around the valve seat area, a common problem. This really should be done by the magnaflux method by a machine shop. Some cracks can be repaired by cold-weld process. If the bore is too big, you can sleeve the block and go back to the standard bore, or at least to the pistons you may have. One important item is the valve lifter bores. If they are badly rusted or pitted, this may mean the end of the block at this point. I know of no oversize lifters of the solid type, or bodies of the hydraulic type. To have too much clearance at the lifters means 24 places to lose some oil pressure in the hydraulic models, a point we do not want to happen if it can be avoided. If the block checks out okay as to cracks and lifter bores, it is time to have it rebored to the piston size you want to use. If a few cylinder bores require a much bigger size to clean up out of round or pits, you can sleeve only the bad bores, but bore the sleeve to equal size of the non-sleeved ones. Never mix piston sizes. If the block is a good one and the bores measure out all the same and there is minimum taper and ovality, it will not need to be bored, as a simple honing will suffice to prepare it for new rings. The only other probable machine work to the block would be the valve seats. If they are badly pitted or burned to the point that they cannot be ground, new valve seats may have to be installed. I suggest a machine shop do this. The new seat has to be chilled to slightly shrink it before it is inserted in the block. This should be done by an experienced mechanic.

Next, the new freeze plugs can be installed and the block will be ready for assembly.

I will now discuss the crankshaft and the main bearings. First, the 1942-48 crank is best because there are no sludge traps in the crank throws as in early cranks, and the larger rod bearings will give longer wear life to the bearings. The latest crank requires a mating flywheel because of a difference in the transmission pilot bearing. It is in the flywheel in earlier models and in the end of the crank in late models. If it is in the end of the crank it should be pulled with a bearing puller and checked for wear by spinning it in the air and listening and feeling for rough spots. If there is any doubt, replace it as they are easy to get from any bearing house. Also, the latest flexible flywheel requires a late model starter, or a modification to the starter drive gear by reducing its diameter a bit to clear the flywheel shoulder diameter.

Now, depending on what crank you have available, proceed to have a machine shop turn all bearing surfaces to clean up the score marks and grind to a correct bearing undersize. These are in increments of ten thousandths (.010). The machine shop must be told the correct original dimensions of the crankshaft journals so that they can use them as a base benchmark. One more important modification, if not already done, have the machine shop grind off the oil slinger fin at the rear of the crank. The first one just behind the rear main bearing must stay; it is to ride against the rear main to control end thrust. The next one was originally to act as an oil slinger in the upper and lower cavities to attempt to keep oil from leaking into the clutch area. This method did not work very well. By cutting off this rear slinger fin and reducing the shaft to 2.500 diameter, we will prepare the crank for the new rear main seal. Remove the slinger cavities in the block and rear main cap, and replace them with Ford or Mercury main seals. These are sometimes called rope seals. When you install the seal holders in the lock and the rear main bearing cap, use sealing compound such as Ford part #D7AZ-19554-B or equivalent liberally. We want to keep all the oil on the engine side of the block. Some like to line bore the main bearings to be sure they are in a straight line with the block. Note the main caps are numbered 1,2,3, and 4. Install the vibration damper and pulley assembly on the crankshaft before installing the crankshaft in the block. Also install the upper front crank seal which is a rope affair, before putting the crankshaft into the block.



Probably line boring is best, but it requires new main bearing inserts with plenty of bearing material which will be removed in the process. However, I did not do this. My bearings were ordered to the proper undersize to match the crank size to which it was ground. I then installed the crank in the block, complete with bearing halves in the block. Slip the lower bearing halves in the caps, and then before you bolt on the caps, insert a strip of *Plastigage* (made by *Perfect Circle*) (Editor's Note: Now a Clevite product) for measuring bearing clearance in each cap. Get the .001-.005 size in the green sleeve. This piece should run fore and aft the width of the bearing.

Then torque the main bearing cap bolts to 70 ft-pounds. **Do not turn the crank**! Then remove all the bearing caps and examine the squeezed out *Plastigage*. By looking at the width of the squeezed material and comparing it to the gauge chart on the paper sleeve it came in, it will tell you your clearance of the journal to the bearing. It should be between .001 and .003, and .0015 would be considered perfect. Ideally, they should all be alike if the machine shop and the bearing people were on the ball. One more thing, the width of the flattened material should be parallel and the same width fore and aft on all bearings, and the same one to another. This would indicate the straightness of the crank and its grinding compared to the block. My crank and block passed this test very well even though I did not line bore.

If you are using an early crank, 1941 and earlier, you <u>must</u> remove one of the plug caps in <u>each</u> crank throw to clean out the sludge traps. If this is not done, I can guarantee your bearings will fail later on from grime feeding out of the crank. By removing only one from each throw, you can thoroughly clean out the trap and not have so many plugs to reinstall. After the cleanout, buy new plugs and make a tool to install them as follows: use two short, round headed bolts that screw into a long nut. These two bolts are to act as a miniature jack to be placed between the crank throws. As you unscrew the bolts it presses against the new plug and dimples it in place. Since you do not want to distort the good plug on the opposite side, you can fit a plate of metal over it so the only one being pressed and dimpled is the new one. After the new one is dimpled in place to look similar to the original, you may want to use a sharp center punch and stake several marks around the edge to help secure the plug. These plugs must be firmly held in place because if you run up to 50 pounds of oil pressure, they can blow out if a good job is not done here. Use extra care on this. If you want to do a first-class job on the crank, it can be hard-chromed on the bearing surfaces for extra long life.

The final bearing fitting is the rod bearing clearance. Do the rods with *Plastigage* like you did the mains. Torque for connecting rod cap screws is 45 ft-pounds. They should measure from .001 to .003, with about .0015 preferred.

Examine the pilot bearing at the end of the crank, or in the center of the flywheel if yours is an earlier model than 1942, for wear, skipping, looseness or noise. If it is badly worn it ought to be replaced, and in any case, it should be cleaned and packed with grease. Examine the timing drive gear on the front of the crank. If badly worn, it will make noise and wear out the timing gear. Replace if necessary.

At this point the cam bearings should be pressed in the block. This usually takes a special tool to prevent bearing damage. All bearings except the rear one should have the oil hole pointing down toward the bottom of the block. This is to prevent another loss of oil pressure as wear takes place in use.

The cam should be inspected and any clean up should be done by an experienced machinist. Extra wear and noise will occur if the lobes are not in good shape. After the cam is given a clean bill of health, carefully install in the block. The sharp edges of the lobes can cut the bearings if it is just done sloppily. You can now check the gears and bearing plate that drives the oil pump and mounts on the rear of the block behind the cam. When gears and bearings on this plate check out, install and use sealer again under this plate and on the bolt threads. This is another point where oil could leak out of the block and into the clutch housing. Use care here.

With the cam and rear plate installed, choose your timing gear, fiber or aluminum. Aluminum will last longer, but sometimes makes a singing noise. Fiber may not last as long, but runs quieter. However, it has been said that the fiber gear will not endure under the extra valve spring load of the hydraulic lifter setup. Take your choice. If your crank drive gear is used, pick a timing gear that is at least .005 to .006 oversize, if possible. End play of the cam shaft can now be checked and is controlled by the front cover plate. End play should be about .010 from the timing gear to the back surface of the front plate. If too tight, dress the front surface of the timing gear hub. If too loose, shim between the cam hub and the gear and then bolt together.

There are two different cam grinds; the 1936-37 is for solid lifters and the 1938-48 is for hydraulic lifters. If you do not use the correct cam grind for your lifters, whether solid or hydraulic, you will have a noisier engine, and maybe poor performance. So choose the grind for your lifter choice.

If you choose solid lifters, the adjustable ones are the easiest to adjust and adjust again later in use, if necessary. The non-adjustable ones require grinding the valve stem off to get the required clearance of .012-.015.

If you choose hydraulic lifters, check first the lifter bodies, if they are used ones. They can be interchanged, and if scored on the bottom, they would need to be resurfaced to prevent cam noise and perhaps extra wear.

Now to choose 24 hydraulic lifters to go into the bodies. If you need new ones, they are still available from White Motor Company for White trucks. The only thing that is different is a long pipe stem on the lower end. This stem must be cut or scored and broken off to fit in the body. Be sure no filings get in the check ball valve in the bottom of the hydraulic push rod.

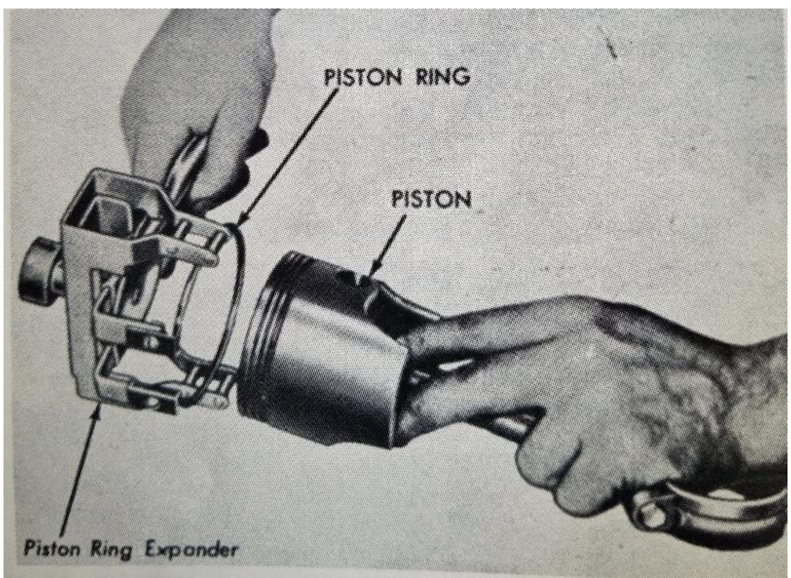
If you are using old lifters, a careful check and cleanup of all must be made. Clean thoroughly with lacquer thinner and alcohol. And do not mix plunger and lifter. To check these lifters (the manual calls them push rods), fill the lifters with a light oil like Marvel Mystery Oil. Pump up the plunger by hand and see if it holds pressure. If the check ball valve in the bottom leaks, and re-cleaning it does not correct this leak, the lifter is no good. All lifters that pass this first test can go to the next check. You need a calibrated weight to push down on the pumped up lifter to check the leak-down rate. I used my ¼" drill press, disassembled it and reversed the spring so the drill press pushes down instead of up. I installed my regular ¼" drill in the press with a piece of ¼ stock with the flat end in the drill. Fill the lifter several times to pump it up. Then allow the drill press with its spring reversed to push down on the lifter to cause it to leak down. A good one will take several seconds to leak down. If you have a new or known good one for comparison check the timing in seconds for leak down, or compare all of your old ones to establish an average time for most. You want to weed out the ones that leak fast, in comparison to the average good ones. On one that leaks too fast, you may prevent this, provided the check valve in the bottom is okay, by trying a different plunger. You will find plungers are different sizes; some too tight and some very loose, but you may be lucky to find a correct size out of lots of old lifters, to save a lifter that has a good check valve. After all checks are made, you then want 24 lifters that hold oil and leak down at a uniform average rate, and if they pass this test, they will work.

With cam and lifters in place, it is time to install valves. Lincoln valve springs should be used as they have more tension than the similar Ford springs. The Lincoln springs have wide spaces between turns at the top end and close spacing on the lifter end. We have several choices on valves and guides. The original guides were split and the same as the Ford's. Then in 1938 the intake valve and its guide were changed to prevent oil usage by the drilling of a little hole in the intake guide which bleeds enough air to stop the suction (or it was supposed to). This is the better of the split type, but still not good enough. You should use Ford 1949 to 1951 one-piece guides and valves.

Next, hand select the valve to guide fit and the best select fits use for the intake service. If you want better oil control than this, here are three suggestions. Les Keeton drills out the guide and presses in a bronze sleeve whose inner dimension is select fitted to the valve. I used this following method: put the guide in a lathe and cut an "O" ring groove inside the inner bore of the guide near the spring end to hold captive an "O" ring that just fits the valve stem. Then when the valve is inserted in the guide with the captive O ring you have a built-in oil seal. Another way is to add a press-on seal on the end of the guide made by *Hastings*. However, the guide has to be milled to fit the seal and you lose the bottom groove which is there for the valve assembly installation tool.

I prefer the O ring method, and I installed them on all 24 valves, even though most people say they are only needed for the intakes. Perhaps it was overkill, but the job was not all that hard to do. I hand lapped each valve to its individual valve seat with grinding compound for a perfect seal. With the then assembled valve and guides, install it in the block. Be sure the large seal around the guide that seals to the block is in place and fills out the block bore. I bushed mine out slightly to make a good seal. Then with a lifter bar, compress guides down and install the big horseshoe keepers to secure the assembled valve guide in place. At this point if these are solid lifters, clearance of .014 to .016 should be measured between valve and lifter. No measurement is needed on the hydraulic models.

Pistons and rods can now be installed. Note: Rods are numbered and if they are a set from the original block, try to keep them that way. If you have a good set of original iron pistons, I see no problem. If you have to buy all new ones, you may prefer the aluminum type. Sometimes aluminum ones may make a slight slapping noise in a cold engine, but other that that they are very good. If you are using old pistons, clean the ring lands and grooves thoroughly of all carbon, but not with a wire brush as you do not want to lose any metal at the rings lands and groove area.



Installing Piston Ring on Piston.

Use care in installing the new rings to prevent breaking due to too much expansion. Les Keeton recommends Hastings rings as the best. To check for correct size ring bore, push a ring down part way in the cylinder bore using a piston body, and measure the ring end gap where the two ends meet. It should be .008 to .013. Grind it or file it down to between these dimensions. When the rings are installed on the piston, the top ring gap should be toward the front of the engine, the second ring gap to the rear of the engine and then evenly stagger gaps on the third or oil control rings. The piston pin should be a light slip fit in the piston. Apply some engine oil on the piston and ring assembly when ready to insert in the cylinder bore. A large hose clamp like a modern radiator hose clamp big enough to fit the piston will serve as a ring compressor, but it is better to use a regular ring compressor as it is quicker and will compress all the rings at once. As you slide the piston and rod assembly in the bore, watch the rod end so it does not score the crank shaft journal. Install the rod bearings and rod caps with the bolts and bolt keepers. Torque the rod bolts to 40 to 45 ft-pounds and install the safety wire in the main studs. Also, bend over the tabs on the rod bolt keepers against the flat of the nuts. **Be sure to use engine oil liberally on all bearing surfaces during final assembly to avoid a dry start.**

You are now ready for the clutch and flywheel assembly. The flywheel and pressure plate should be turned and trued up at a machine shop first, if necessary. Then use a small torch lightly on the clutch surface of the flywheel and pressure plate to boil out any oil residue. Do not get the metal too hot. Then clean carefully. Use a new clutch of the best variety you can get, which should be the very latest 1947 or 1948 Lincoln replacement clutch if you can find one. We are trying to get a good one to last and prevent unnecessary shudder when shifting gears. When the pressure plate is installed, a clutch pilot tool or an old transmission drive gear shaft must be used to center the clutch in the flywheel and pressure plate assembly. Failure to get this centered will make it impossible to get the transmission to insert in the clutch on engine assembly, so use care in the centering process as it will pay off in the engine installation.

Next will be the oil pump. There are three types: the old style, the post-war replacement – 5EH variety and then the best, 8EL or '49 Lincoln type. Even in the best of condition the old type does not provide enough flow of oil and usually not enough pressure. The 5EH type does a much better job and requires some modification of the pan baffles, if used on an early oil pan installation. This pan work would already be done on a late model engine and pan. The end play of the pump gears along with snug bearings on the shaft are key items to make the pump do a good high-pressure job. The '49 8EL pump will have the most pressure and volume of oil and is best. You do have to drill and tap a new mounting hole in the block so the pump can be mounted with the pickup tube pointed in line with the crank. You have to do this to get clearance for the oil pan. You should try the pan with the pump in place before you drill the mounting hole. You have to fabricate an oil pickup tube and screen for the 8EL pump or make one from a 5EH one, making sure it fits in the cavity in the bottom of the oil pan.

If you are using a pre-war crankshaft with plugs in each end of the rod journals, too much oil pressure could blow them out. An 8EL pump can deliver well over 50 pounds unless you shorten the bypass valve spring in the pump. You can do this two ways: either cut off one turn, as recommended by Les Keeton, or do as I did, use spacer washers under the cap nut for the spring which makes it act like a shorter spring. This would allow the bypass valve to open sooner and hold down the upper level of oil pressure to hopefully around 50 pounds.

When the pump is installed in the block, be sure the rubber O rings top and bottom are on the pump shaft and are lubricated so they will slip in place as the pump shaft is inserted in the block. To lose an O ring would reduce oil pressure from the pump.

If everything underneath the block looks good; crank, bearings, wires on the main cap bolts, pump installed and positioned correctly for pan clearance and oil pick-up screen, flywheel and clutch in place, and vibration damper and pulley on, it is time to install the oil pan.

Make sure the baffles are in place in the cleaned pan. Soak the upper and lower front seals a couple of hours in oil before installing in the pan and front cover. Install the lower half of the front engine seal in the front of the pan. Install the cork seal on the rear main bearing cap. Ford sealer type D7AZ-19554-B is good for these seal areas and the pan gasket. Use extreme care on sealing the pan, especially at the rear where the partition meets the block and cork of the rear main cap. Use sealant on only the pan side of the pan gasket. A leak at the rear goes straight to the clutch area. If you are working with the engine in the car, as when you are only checking bearings, tie the front end of the two gasket sides to the oil pan with thin sewing thread in the first four holes, as it is easy to displace the gasket when you are snaking the pan into place to install on the block.

If you have the block on an engine stand, you can see what you are doing and this step is not necessary. I used a fiber-type pan gasket cut from gasket material rather than a cork one which I thought was a little tougher and more secure. Do not forget the oil level float before the pan is installed, and do not crush the can as this will cause it to leak and the float will sink to the bottom of the pan and not indicate your oil level.

If all work is finished at the front of the block, seal the gaskets and install the front plate over the timing gear area. Exhaust manifolds can be installed with new gaskets at this time if you took them off. You will probably want to paint the block Lincoln green before the manifolds are installed, and also paint the manifolds with hi-temp black. The black will soon burn off, but will leave it a kind of clean gray and will look better than a rusty one. The pan should be gloss black.

One point here about the vibration damper. If it was badly rusted around the springs and retainers, it should be disassembled and thoroughly cleaned first before painting. If rust and corrosion have gummed it up, it will not perform correctly.

Now that we have the bottom of the block buttoned up, we will address the top of the engine.

Now, working on the top side of the block we have several items to consider. If the engine is a hydraulic lifter model, the check valve at the rear of the engine near the fuel pump push rod needs to be either checked carefully for a broken spring, or a new valve installed under the big cap nut. If this check valve does not work, pressure is not held and regulated properly in the lifter supply line, and lifter noise can result. The failing item in the valve is usually the bronze spring worn in two pieces and keeping the check ball from seating. It can be repaired by drilling out the stake marks and unscrewing the pieces of the valve. A new spring can be made. Be sure to note the barrel shape. This should pop open at about 4 pounds of oil pressure. You can use a rubber battery filler to supply air, hook it up with the valve and a fuel pump pressure gauge. As you supply a burst of air from the rubber filler, the pressure gauge should jump up to about 4 pounds as the check ball unseats itself. Then when adjusted by screwing down the top slug, re-stake the valve assembly. The front check ball is a 3/8” steel ball and should be replaced if it is scored or pitted. The front spring is 1” long free length on hydraulic models.

If the solid lifter model is used, originally at the rear was a metering hole instead of a valve in the early blocks. Most people using a late block with solid lifters install a brass plug in place of the check valve to keep oil from flowing down the lifter supply line. In some cases they stop up the forward end of the lifter line also. Originally the front spring for the 3/8" steel ball was a 1 3/16" long free length. The purpose of the front spring and ball was to pop open at about 20 pounds oil pressure to flow oil to the timing gear. If pressure was low, and many were with some miles on them, the gear might not get much, if any, oil. Several ideas for a better oil supply have been tried, such as a small supply line from the big cap bolt in back run to the front to dribble down on the timing gear. Another idea was to drill straight down from the check ball area and hit the supply line for the front cam bearing. Then plug the front end of the continuous pressure to the timing gear. I did not modify this on my hydraulic model, and if you run good oil pressure like 45 to 50 pounds cold and 15 pounds or so hot idle, the normal oiling method should keep the gear lubricated.

Another item to check carefully to preserve good oil pressure is the fit of the fuel pump push rod in its bushing which is pressed in the block. If either is worn badly, oil pressure is lost or reduced here, so either or both should be replaced. The bushing should be replaced before the cam is installed if this item is bad.

We will discuss engine breathing here, specifically the crankcase and valve area. The HV-12 was woefully inadequate in this regard. The original setup is a small tube from the intake manifold to the air cleaner. This worked passably at high speeds, but did very little at slow speeds like much of our driving is done. There are three ways to improve this: some sort of forced blower method, a down draft tube similar to later model Fords mounted on the oil pan, or a PCV (Positive Crankcase Ventilation) valve. I chose the PCV valve method because it works at idle, and left my regular air cleaner tube in place for high speeds. On the PCV installation, I mounted a plate under the carburetor from a Stewart Warner gas heater kit, and screwed in a PCV valve like the 1964 Lincoln used. Then I routed a rubber hose from the PCV valve forward to a U-shaped piece of small piping which is inserted into a hole drilled into the front of the intake manifold in the center of the generator slotted mounting bracket. In this way air is pulled in at the back of the block through the oil filler cap, all the way through the internal block, and sucked out at the front to the carburetor, just like a modern car. The carburetor will adjust to a smooth idle just as well as before.

For those who want to go the crankcase vent and road tube route, use the 1954-57 Ford ventilator which can be mounted to the side of the oil pan. It requires some brazing, and the cutting of a 1 7/32" in the pan. Bernie Holland (*Ed. Note: Bernie Holland was a west coast parts vendor who passed away in 2005*) handles these and the adapter plate is included in the kit, as well as instructions for mounting. Any method of ventilation you use will extend the life of the HV-12, by ridding it of the corrosive interior fumes with which it is plagued. That is the reason why so many people have said in the past that you have to drive an HV-12 hard all the time, it was the only way to get rid of the fumes, which immediately then found their way into the car and gagged the occupants. The fume exit was at the oil filler cap, which sits right in front of the cowl ventilator!

If all items are accounted for so far, the intake manifold and heads can be installed. I use a copper-based sealer lightly applied to the head gaskets before installation. The metal or copper clad gaskets are okay for cast iron heads, but only the fiber type should be used on aluminum heads. Torque head bolts in a pattern like the book, basically starting in the center and working out in all directions. Iron heads are torqued to 40 to 50 ft-pounds, and aluminum 35 to 40 ft-pounds.

After the engine has run and warmed up, iron heads should be re-torqued while hot. On aluminum heads, let them cool off after running, then re-torque. To monitor oil pressure or check the gauge, you can install a fitting in place of the pipe plug at the rear of the engine block near the oil filter supply pipe. This fitting can mate with a hose to a gauge such as a refrigeration charging unit and provides an accurate method of measuring oil pressure. The brass fitting can then be capped when finished.

It is not a bad idea to turn over the engine till oil pressure is developed so nothing is dry when starting. There is some controversy here as it has been said that you can do just as much harm turning it over for a long time with the starter until the oil pump gets the oil up to the bearing surfaces, as it would be to turn the engine on and let the pump lubricate it in the normal manner. It is a good argument for using oil as you assemble the engine, on any surface that is going to rub against anything else. Some people push the car, and some use a 12-volt battery to help the tight engine start in the beginning. If you use the 12-volt battery, do it in short spurts of about 10 seconds, as a long session will harm the starter electrically. The starter, carburetor and distributor must all be in good shape to help start a tight engine. The carburetor should be filled with gasoline to within ½" of the top of the bowl, as of course, the fuel lines will be dry when you hook it up. With a little bit of gas, air and electricity, it is bound to light off.

A good procedure for timing of the distributor is as follows: <u>before</u> the heads are installed, find top dead center of number one piston (front on left side). Make a mark on the front vibration damper disk at twelve o'clock or straight up, using the distributor front center boss as a guide. Turn crank counterclockwise and make another mark with white paint ¼" from the first. This represents 4 degrees BTDC. Then turn the crank till the next firing piston comes up which is number four (the second from front on the right side). Mark TDC and the 4 degree BTDC as before. Now you can use a timing gun as in the next paragraph.

The points should be set at .014 to .016 spacing. Then while engine is idling, a regular dwell meter set on 6 cylinder setting is connected to each half of the coil at the condenser, and dwell should be 34 degrees to 36 degrees. Points should be readjusted to achieve this dwell like a modern car. Then, with a timing light, first connect to #1 cylinder and time to the 4 degree BTDC mark by moving the timing marker screw and scale up or down on the distributor side. To then time the # 4 cylinder with the light, adjust the second timing screw which is located under the first screw's calibrated plate. You can carefully remove the plate to set this screw and then re-check #1 piston with the first adjustment. The vacuum brake screw can first be set about ½" out from the lock nut. Then counterclockwise turns of the screw will start to make the car "ping" under a load. If the engine just barely "pings" under a heavy load, this is the ideal timing for peak power and performance.

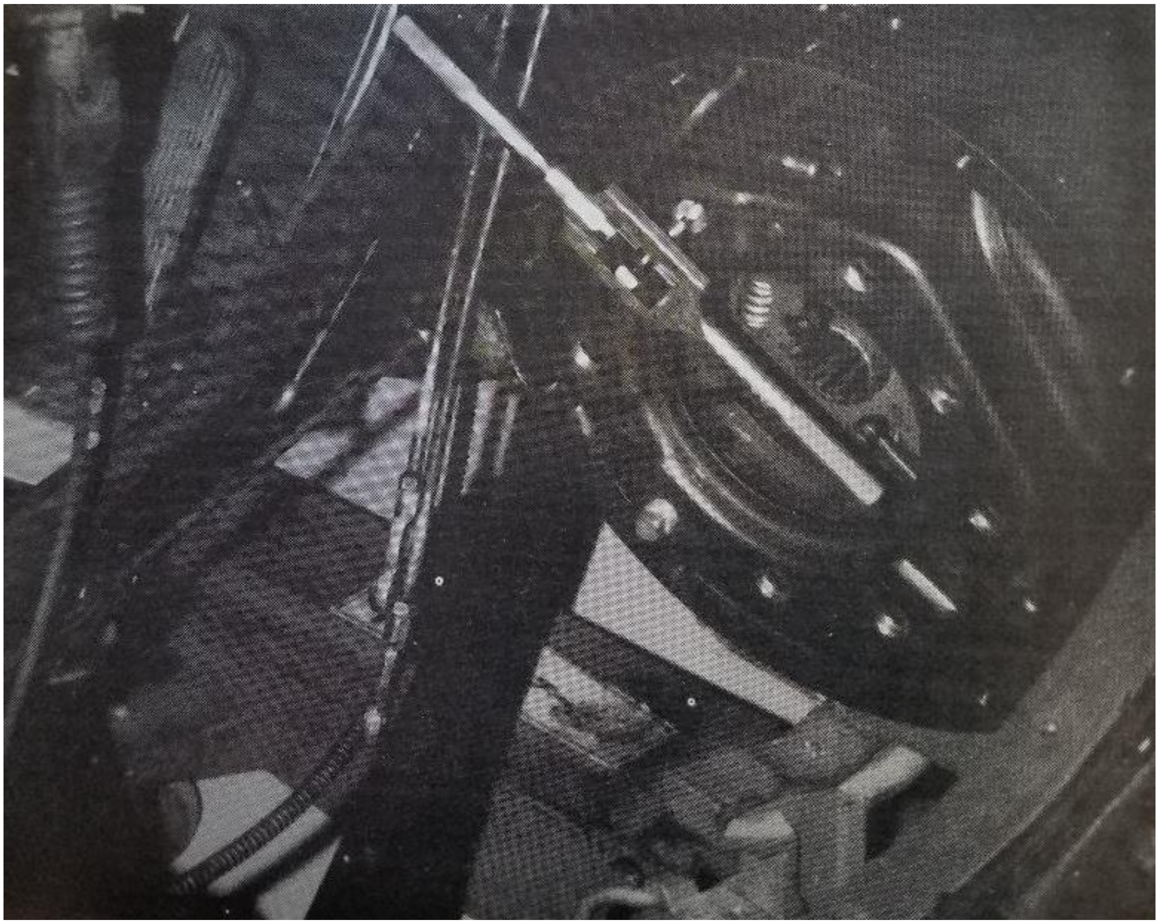
We should now review the list of modifications that we may do to the HV-12 that were not standard, or original.

1. Crankshaft rear slinger fin removed and Ford-type shaft seals installed.
2. 8 EL oil pump for better flow and pressure.
3. Solid lifters in 1938-48 models.
4. Removing brass check valve if solid lifters are to be used in 1938-48 cars.
5. One piece valve guides and Ford valves to fit.
6. Oil control on valve guides either by bronze sleeves in a select fit, or Hastings valve guide seal, or captive O ring installed in lower end of the valve guide.
7. Various methods of supplying more oil to timing gear like drilled passages or added supply line to feed gear.
8. Addition of timing marks on vibration damper to aid in future timing checks of engine.
9. Crankcase ventilation by either down draft tube or PCV valve installation.
10. Brass water baffles at rear of water pumps to aid in engine cooling.
11. A method of balancing out engine vibrations after engine is installed and running.

Engine balancing can be achieved as follows: Hook up a tachometer on point-to-coil connection to monitor vibrations at various RPMs. You may notice several vibration peaks so work on the worst RPM vibration first. Tie a small piece of wire on a dash knob and steering wheel. When the RPM of the worst vibration is reached, note the amount of motion of this piece of wire like a gauge. When you hit perfection, the wire will get almost still at various RPMs. By removing the clutch inspection plate, you will see nine holes in the back of the clutch pressure plate assembly. The idea is to install a lead weight in a hole, one at a time, as you retry the engine to hunt improvement. I poured my weights from old wheel balance lead weights. I made a piece about ½" to ¾" long that just fits the hole in the clutch assembly, mark with a chalk mark the starting hole, and you can secure it with masking tape for each trial run.

When you hit the right spot, you will notice an improvement in vibration. When, like the wheel on a car, it may take a second or third weight to finish the job to perfection. It may sound like a slow job, but the reward of a very still engine while running is well worth it. When all the weights are finally decided as to how much and where, I secured them in place by drilling a hole in the lead cylinder, off center so a sheet metal screw will screw in, the treads poking out of the lead cylinder and grabbing onto the metal side of the hole in the clutch assembly. This will hold them in securely.

Another balancing trick involves drilling out the holes in the clutch housing and tapping them, as shown here. Then you can screw in pipe plugs where necessary to balance the engine.



A floor jack holds up the end of the engine.

The rest of good engine performance will depend on all the regular items that affect a car running well, for example, a good carburetor, proper fuel pump pressure, good ignition system (complete including coil, points, wiring, rotor, spark plugs, and distributor terminal plates), and complete electrical system from battery to starter and charging system.

Actually, the engine requires little more than any engine to make it run well besides the modifications that were aimed at factory shortcomings or a series of improvements. The best engine reference book is the ***Repair Manual Lincoln V12 Engines, H Series 1936-1947, No. 3693***, dated January 7, 1947 by Ford Motor Company.

The final reward cannot be measured in time or effort. When people who really know cars listen to the V12 idle, or better still, drive it to compare it to our modern cars, they are usually astonished at the smooth response of the 12. You then look at the good oil pressure on the gauge and expect up to 18 MPG with overdrive or two-speed, up to 1,000 miles before oil is needed after break-in, good engine starting and running, and if and when these tests are achieved, you have finally arrived in a V-12.

Details on Rebuilding the HV-12 Your Mother Never Told You by Robert Prins

A few issues back, Jake Fleming, the Wiz from Dallas, Texas, wrote about the general steps in re-building the HV-12, and in the past 40 years there have been hundreds of tips by a host of experts, experienced "non-experts" and dilettantes on how to improve the mill. WHY?? Let's face it, demons, the beast is a beast: poor cooling ability, poor oil distribution, low horsepower to weight, (1938 on), predilection to use MUCH oil after break-in, high repair to mileage ratio. All in all, if FoMoCo had spent more research dollars it would have alleviated our primary problems. But there it is, folks, and we have to live with it. I have given up defending it as a waste of time. Its enemies (mostly GM types) won't buy FoMoCo anyway, so why argue with a closed mind. Our chosen LOVE has a wart. BIG DEAL. So what's good about it? Well, it is a most beautiful engine to look at, especially the intake manifold. It is FAST, faster than most of the competition of the day – Why would ALLARD have used it? In fact, it is a superior power unit at speed. Pat Phillipi once said that the best way to preserve the V-12 was to drive it all day at 80 MPH plus - gets the gunk out, allows the oil pump to finally get oil to the right places, keeps rings loose, and allows the water pumps to get coolant to the rear of the block. Overdrives help MPG and keep RPM noise down but this engine needs to run at 4,000 RPMs plus. Another good point, once the HV-12 gets to the oil burning, or rather, oil using stage, it is good for 100,000 miles more – THAT can't be said for the competition. That is, if you don't mind blue smoke. There are quite a few things that can be done to improve what FoMoCo wouldn't. In the next issues, we will hold a forum in these columns to that end.

OILS - There has been much MIS-information bandied about over the best oil to use in an HV-12 engine. If you contact any engineer in the oil, motor oil, that is, industry, you will be told in no uncertain terms to use the BEST "SF" multi-viscosity, HD oil that can be had. Yet, to hear old time mechanics talk, the single grade, non-detergent oil is the "ONLY" oil to be used in ANY old engine.

QUESTION: Who knows more about oil lubrication, Oil Engineers or "OLD" mechanics?
Pro View...The new oils are better lubricators. The new "SF" grade oils have slippier qualities, better clinging to surface abilities, higher heat-to-breakdown ratios. The ability to keep dirt in suspension so it can be thrown out at change, rather than kept in the engine at change, longer viscosity life; the ability to hold viscosity at high heat. Con View…The engine was designed for the non-detergent oils (Detergent oils weren't around then), dirt can find a cozy corner to hide in and not get in the way. There is no full flow filtration system to catch dirt. There must be others.

If you are re-building your V-12 and all parts have been "cooked" in a machine shop hot tank, especially including the block, so that you are starting out with a clean "new" engine, by ALL MEANS use the latest "SF" grade multi-viscosity oils. You would be crazy not to. However, if your engine is an older re-build or "original" and well run-in, say 30,000 plus, continue using the older non-detergent oils as the new oils might dislodge lots of gunk and perhaps ruin what you now have.

As the old V-12 does not have a full-flow filtration system like the new engines do, you should change oil every 1,500 to 2,000 miles, including the filter. Whichever oil you choose to use, KEEP THAT V-12 CLEAN, Not outside, INSIDE.

WHY NOT USE SOLID ADJUSTABLE VALVE LIFTERS?

Blasphemy you say! Nonsense, say I. Les Keeton of Anderson, CA uses this setup and his V-12 is the quietest engine in the universe. There are some hitches. The re-builder (you) needs to take care of some important details.

1. The oil feed folds for the hydraulic lifter galleys, both front and rear need to be blocked off (see Fig.1). These oil passages are not needed for the solid lifter. Flat heat Ford V-8 engines do not have these oil passages for the solid lifters, so the V-12 doesn't need them either. The proper solid adjustable lifters have side grooves which pick up oil from the crankcase via splashing. (See Fig.2).
2. You should (not must) use a 1936-1937, H6251 camshaft or have your 86H or 06H-6251 camshaft ground to 1936-1937 specs. If you use the hydraulic valve lifter camshaft (86H or 06H) as is, be prepared for some clatter as the lobe contours are for hydraulic lifters ONLY.

Specs for the 36-37 Camshaft are as follows:

Intake Opens	Intake Closes
(Degrees B.T.C. before top center)	(Degrees A.B.C. after bottom center)
19.5 degrees	54.5 degrees
Exhaust Opens	**Exhaust Closes**
(Degrees B.B.C. before bottom center)	(Degrees A.T.C. after top center)
57.5 degrees	16.5 degrees

3. An oil line, made up of 1/8" brake line must be installed between the rear and front 6666 oil relief plugs (See Fig. 3). This way the cam gears can have plenty of lubrication, something they did not get much of with the hydraulic lifter setup. Drill and tap each 6666 oil plug (center top) for a 1/8" pipe size 90 degree inverted male elbow, tube size being also 1/8". The tube must be custom fitted to each end with an inverted flare and 1/8" male fitting (See Fig. 4).

The solid adjustable lifter to get is the SEALED POWER #AT-770 still available at any good auto parts outlet. As stated previously, they have large lubrication slots that pick up oil from the splashing of the crank as it revolves. If the lifter oil passages are not blocked off at the source, most oil pressure is lost at the first two lifters and all pressure by the third and fourth. It is not essential pressure like crank and rod bearings but it is wasted, so block them off and let the cam gears get it. Adjustable lifters should be set .014 cold, between lifter top and valve stem bottom;

then re-set again after a run-in, hot. You can use the old '36-'37 solid lifters (non-adjustable) if you do not have to grind the old '36-'37 cam, but if you grind the camshaft you <u>must</u> use adjustable lifters. With this setup you gain a lot of oil area so need less oil volume; consequently, the old 86H-6600 or 06H-6600 oil pump. It pumps half again as much oil in volume, but you must use the 56H-6688 oil pan tray to accommodate the pickup. Best yet, use the *Melling* M-19 oil pump, made to replace the pump in the 1949-1953 Ford engine. It bolts right in except you have to re-direct the oil pickup tube, no big deal, believe me. This M-19 pump uses helical pump gears and is as good as or better than the 56H pump. I have come to believe that the much touted 8El (1949-1951 Lincoln V-8) pump has too much volume, if that is possible; is too expensive and overrated. I had one in my 1947 Continental Cabriolet and had valve float and dramatic loss of power at 55 to 60 MPH when accelerating---who needs that? Oh yes, the *Melling* pump is also still available at your friendly auto parts outlet for about $25. ADAP also carries them under the SEALED POWER name---ask for the '49 – '53 Ford-Lincoln pump.

<u>VALVES – USE THE CHEVY 327</u>

Les Keeton came up with this one. While slightly longer, the Chevy "small block" or "327" engine exhaust valve is a high-quality valve, with a heavier, thicker head and a hardened steel stem end. It is superior to the 06H "split guide" and the 8BA Ford "solid guide" valve. It is also a better grade steel with a higher heat range. The stem diameter is identical to the 8BA valve, so no adjustments need be made in the 8BA one-piece guide. This valve is a must, it would seem to me, if the camshaft has to be re-ground as either the valve seat would have to be sunk or the lifter body changed (Ed. See Alan Whelihan's column on this). About .100 needs to be ground off the stem end when using the hydraulic lifter, but this valve can be used as is with solid adjustable lifters. Use the first groove for the spring retainer locks. (See Fig. 5).

<u>MISCELLANEOUS HV-12 REBUILD TIPS</u> by Tom Lerch

1. The connecting rod locking tabs that prevent the rod bolts from turning are always available from Earle Brown of Pennsylvania (listed in the roster and in Classified ads in *The Way of the Zephyr*), who has a goodly supply of them. They may also be available from your handy parts store as Dorman part number 617-206, size 13/32, called a star washer and packed 25 to the box. You'll need them, as the old tabs invariably break off when you try to re-use them.
2. The HV-12 engine rebuild manual cautions you to keep the numbers on the rods towards the front of the engine. This means the numbers on the rod ends and the bearing caps, **<u>not</u>** the 86 or 06 or 26H casting numbers on the rod. The rods are numbered 1 to 12, **<u>stamped in</u>**. Just one rod in backwards makes a clatter, six in backwards makes a helluva racket. (But beware – I have taken them apart and found all kinds of numbers in no sequence, indicating that whoever did it replaced rods and caps from another engine and did not bother to file off the old numbers and stamp in the correct ones. Tech. Ed.)
3. Check end play on the crank. Be sure it is al least .002" minimum to .006" Maximum. No end play will quickly ruin the rear main due to galling or overheating. Too much end play makes noise. Check with a feeler gauge between the forward edge of the rear main bearing cap and the machined surface at the bottom of the counterweight cheek in front of it. Check this before putting the rods in. If there is no end play, remove the rear

main bearing and gently rub it about 20 light circular strokes on #320 sandpaper (wet) for about .001" removal. Then tape the two bearing halves together and sand off the forward edge only, being careful to hold them flat as you sand. If the end play exceeds .006" get another rear main bearing and try it, as they seem to vary a little.

4. Should you replace your bearings? A product called *Plastigage* will exactly Measure bearing/journal clearance, is easy and simple to use, and accurate. It will also measure taper. See your auto parts counterman for *Plastigage*, its sizes, and the little guide to use it. Simply put, it is a tiny plastic thread that is placed across the bearing surface, the bearing cap is then torqued down to specs, and then removed at once. You will see the plastic has been squashed flat. The paper envelope has a gauge which you lay up against the flattened *Plastigage*, measuring its width in bearing clearances of thousandths of an inch. There is really no point in replacing excellent bearing surfaces if they are within specs, unpitted, and unmarred. If pitting is visible, the bearing surface is beginning to go, and the replacement should be made, even if they are within specs.