Insights

INTO THE

FORD FE

(FAIRLANE ENGINE)

BY JIM DOVE

In an effort to inform and educate both the novice and the experienced Hot Rodder who may be embarking on an adventure in Cobra Land, we will deal with the FE Ford Engine, including the 332, 352, 360, 406, 410, 427, and 428 CID of Ford Engines.

To start with I would like to go over some reasons to use a FE Engine in that Cobra or other Ford project and dispel a few myths.

The letters "FE" do not stand for the chemical symbol for "iron". In this case, they are the initials for the Fairlane Engine. The Fairlane was, in 1958, the top of the Ford line of cars, for which this engine was developed for use in. The first version of the FE was a 332 CID at 265 HP in 4BBL trim, followed shortly by the 352 at 300 HP with the 4BBL. In 1960 the 352 was updated with a hot cam, new heads, an aluminum intake manifold, free flowing exhaust manifold, and a rating of 360 HP. By the end of 1960 Ford had won 15 Grand National races, more than any other make. By 1961 the cubic inch race had started and development of small CID FE's had stopped.

In 1961 the 390 was born. It used the same heads, cam, and manifolds as the 352 and also had the same option of the famous 3 deuces or 6-V as Ford called it, which took the HP to 401.

In 1962 the 406 was developed and with it came the now famous cross bolt mains. Very few 406's had the cross bolts. They were found mainly on factory race cars.

In late 1962 the 7-liter limit had not gone into effect yet and Ford produced a few 483 CID FE's but 1963 brought the NASCAR 7-liter limit. (The 483 was the first FE to use the 4.233 bore size—the stroke was 4.3".)

In late 1963 the 427 sprouted the now famous Hi-Riser Heads. The Hi-Riser Head has provided the base for our most potent head designs to date.

In 1965 NASCAR outlawed both the Hi-Riser Ford and the Chrysler Hemi. Chrysler had a fit, but Ford was strangely quiet. Ford had developed a new Medium-Riser Head that would out flow the Hi-Riser Head of the day. However, this Medium-Riser was not the one that came from the factory on new cars. These heads became known as the SK Medium-Riser and had much better ports than the standard Medium-Riser. This special Medium-Riser port became the base for our Dove Aluminum SK Medium-Riser Head. Also in 1965, the Side Oiler Block was developed.

Ford developed a few aluminum Medium-Riser Heads (Casting #C6FE-6090-F). These heads are not desirable for use in performance applications as they were part of the GT-40 project and they were de-tuned to lower the power

out-put to increase durability for 24 hour races such as the 24 Hours of Lemans. The chambers are too big, the ports were too small, and the casting too thin. Their value is only as a collector item.

The Fords ran well during the 1965 and 1966 NASCAR seasons. By 1967 the Chrysler Hemi was back and the Ford SOHC had been factored out of competition. Ford's answer to the Hemi was the now famous Tunnel Port. The new heads had round ports that went straight to the valve rather then bending around the push rods like other wedge engines. The push rods on the T-ports are routed through the center of the port via tube, which incidentally, did not affect the airflow.

These new Tunnel Port Heads were a big hit in all types of racing and gave Ford some of their finest moments in racing. However, the Hi-Riser was still king of the shorter tracks because of it's broad power band.

At Dove, we manufacture both the Aluminum Tunnel Port (SK-37080) and Cast Iron Tunnel Port (#C70E-6090-K) and they are very strong runners even today, especially on large CID engines.

In 1968 the 428 CJ became the rage on the street. A stock CJ would turn the quarter mile at 13.6 seconds at 108 mph. and that's on street tires!

In 1968 the 428 CJ and the 429 CJ were available. The 428 still went 13.6 seconds but the 429 would only turn 15 seconds. Handling with the 429 wasn't good either as the 429 was over 150 lbs. heavier than the 428 FE.

Even today when you look at NHRA class records you will find 427's and 428's but no 429's Or 460's. The FE is faster, lighter, and better looking.

In early super stock days the factory teams would run a lot faster than the private teams would. The reason was that the factory teams were running special heads with better ports than the stock over-the-counter heads. When the sanctioning body found out about the special heads, they asked Ford what was going on. Ford's answer was that the special heads were the ones used on cars built in Canada. NHRA accepted this explanation, however, after this the "Canadian" heads were factored an extra 80 HP and that is how the "Special" heads got their name.

The "Canadian" Cobra Jet head port is the basis for our Dove Aluminum CJ heads. We also manufacture the Canadian CJ in cast iron as an exact replacement of the original. In 1995 we produced an improved 428 CJ Head and Ford has issued a new part number (F5WE-6090-A). These heads have been approved by NHRA for Stock Eliminator and Super Stock competition.

What this head in aluminum means to people building replica Cobras is that peak flow is achieved at .400 lift. This will improve power in all ranges and as an added benefit, fuel economy will be improved. The 427's will benefit from a SK Medium-Riser Dove Head in Aluminum. For FE 427's and larger engines, the Dove Hi-Riser and raised port Hi-Riser Heads will produce world class power to beat all competition in the horsepower race.

As for a choice for powering that 427 Cobra, the FE is the only choice. But what is wrong with a 351-W or a 351-C? The FE Engines of 352 and 360 CID will make more power when comparably equipped. The FE is lighter than the351-C and with an aluminum manifold it is about the same weight as the 351-W. When aluminum heads are installed the FE is 40 lbs. lighter than the 351-W. With this knowledge at hand, there is little reason to build a Cobra with anything but a FE on board.

Even a budget car can enjoy FE power. A 352, 360, or 390 can be found in most wrecking yards. The absolute worst head that was ever used on a FE of any year flows better than either the popular 1969 351-W, 4-V Head, or the new GT-40 Head. Cams cost no more for the FE than any other engine and with no exception. There is no other engine of any make with better selection of intake manifolds.

When you get to a swap-meet there is usually FE Manifolds as far as the eye can see and at Dove we have available a number of different combinations of manifolds. Every maker of manifolds has at least one option for the FE.

We have proven over and over again on the Sandusky, Ohio ½ mile circle track that the FE, both small (355 CID) in our stock car, and the larger (481 CID 1000 HP Fuel Injected FE) in our Super Modified (The Worlds Fastest Short Track Ford) will out power and out last the fastest Chevys in the world. Both small blocks and big blocks. Also, the other Fords including SVO's and professionally built Clevelands.

For the not so budget oriented cars, the 427's are alive and well. With the on-going development of new parts at Dove and other manufacturers, the 427 will outrun all the competition. Blocks were getting hard to find, but not anymore thanks to our new Dove Foundry and up-dated CNC Machinery. We have been able to lower the price on both our aluminum and cast iron blocks and increase production of both.

The cast iron block with a bore capacity of 4.44 is now priced at $3995.00 and our aluminum block with ductile iron cylinder sleeves, are now $4995.00, both a bargain in the millenium.

There is availability of billet crankshafts with up to 4.5" stroke, custom connecting rods of many lengths, and many types of pistons and cams of every description. The FE has now been reborn.

At Dove, we did the FE's before it was fashionable. The fastest Cobras have FE's. With our efforts over the past 15 years and now more and more parts from other manufacturers, I have met my goal, which is to not let the FE die. Now it has new life to take it into the next century, still beating the competition.

Here are few tips about FE Engines.

1. Don't use a transmission from a small block without cutting the end of the input shaft to FE length. The result would be the end of the shaft will bottom out in the crank and cause #2 and #4 main bearings to spin as well as wiping out the thrust main and the crank. This is very important.

2. If your FE is the only one in the engine shop, find another shop.

3. Even a mild FE will accelerate very hard in a Cobra. This will cause the oil to rush to the rear of the pan and let the oil pick up draw air instead of oil. The cure is not to use the stock pan. Even the pretty cast aluminum "T" pans are not good enough. Use an after-market pan with trap doors that will let the oil move to the oil pick-up but not away from the pick-up in all directions. The Cobra pan built by Aviad was used on original race Cobras and works well. The use of a dry sump is highly recommended.

4. When balancing a FE using a 428 or 410 crank, have the crank internally balanced. It only takes one piece of malory metal to do the job. It allows you freedom in choosing or changing clutches and flywheels when you don't have to worry about the Detroit balance of the 428 and 410.

5. There is a fad going around of using 400 Ford rods in a 427, with an offset ground 428 crank. My advice is—Don't Do It! The 400 rod was no good in a 400, why put it in a valuable 427 block?

   The same price will get the crank machined to a 2.2 journal that will fit an off-the-shelf after market rod. Granted, the after market cost more than a 400 Ford rod, however, not by the time you put in good bolts and have the rods reconditioned with the bronze bushings in the small end, resize the big end, have them shot peened, heat treated, magnified, or x-rayed and then lose a $3000 427 block anyway, because they were made of 1041 carbon steel. That's right, no chrome, no moly, no nickel, and no hi-performance bearings available to fit them. A 390 rod would be much better. I've seen Super Stock 428's run over 8300 RPM with properly

prepared 390 rods. There are hi-performance bearings available for the 390 rod and the rod is spot faced to accept the football shaped rod bolt head. The 400 rods are broached, which makes a perfect place for the 400 rod to break. The 390 rod cap is well designed and has large ribs added to the cap for strength. The 400 cap is plain with no ribs. It is designed to run under 4000 RPM with a 2 barrel carb and pull Mark V's and ¾ ton trucks around. It was never even offered with a 4-barrel carb.

The moral of this story is either use the stock FE rods or use one of the premium after-market rods available such as the Carrillo, Oliver, or Manley just to name a few. Don't risk your investment on junk!

Fairlane Engine

So, you have decided to build a FE Engine. Good, because it is the best V-8 to come out of Detroit ever. We will cover FE's from mild to wild and miles to smiles per gallon.

Let's talk blocks. For a hot street engine all FE blocks are suitable. However, the non-high performance blocks need a little work.

The first thing is to select a core suitable for the application. For a performance type street engine any of the stock blocks will do. But, for a high compression race engine you should use a known high performance block or start out with a heavy-duty truck block because they are made from higher strength cast iron.

For a 4" bore circle track engine use a 330 heavy-duty block. It has a 3 7/8 bore and some have cross bolt bosses already cast into the bottom end. If you plan to cross bolt the block, make sure it has the heavy-duty main webs.

For a 4.050 bore 390 or 410 street engine, a 352 block is very good as it has a 4" bore to start with and can be finished at standard 390 bore size of 4.050. Later, it can be bored another .30. For a 10-1 streeter any block will do but for a high compression or nitrous blower use a truck block with heavy-duty main webs. Note: Heavy-duty truck blocks have a large pilot hole to support the end of the distributor. It must be fitted with a bushing to use a car distributor. Don't forget to drill the oil hole in the bushing or the distributor will seize up in the bore from lack of oil.

For a 4.130 bore, it is best to use a 406 or 428 block. Here again, for a streeter with 10-1 CR just about any block will do, but for a high power race motor you must check the block for cylinder wall thickness. Note: A quick way to check for a candidate for a 4.130 bore block is to remove a core plug from the side of the block and use an allen wrench as a gage to check the distance between the bores. Use the following chart reference.

If an allen wrench fits between the bore.....

SIZE	WRENCH SIZE	RESULTS
375	3/8"	No Good
312	5/16"	No Good
281	9/32"	4.080 Max
218	7/32"	4.160 Max
187	3/16"	4.18 Max (In a 406 or 428, good block)
187	3/16" (427)	4.293 (68 C8AZ-6010-G)
125	1/8" (427)	4.310 (Marine Block & some early 427's)

This method does not check for core shift but it does qualify the block for further interest and inspection, such as sonic test, which will find thin spots from core shifts or broken cores.

For a 427 things get complicated. For example, the C8AZ-6010-G Block is supposed to be made from high strength iron. However, they are really only gray iron, like a standard block. If you want a high strength casting the best bet is a '66 casting or one from a 300 HP Chris Craft boat. The problem with boat motors is that they are machined as a top oiler. However, the bosses are there for the side oiler but are not machined. This operation is performed at Dove Performance on a regular basis.

The Marine Blocks are also the choice with thicker cylinder walls. For instance, the front and rear of a C8 Block is around .080" thick. The marine Block cylinder is .125" thick. This, combined with the tough iron, make it the strongest of all factory FE blocks.

The C8AZ-6010-G Block is adequate for most hi-performance operations but when the compression gets over 12 to 1 or the HP over 650 you need a stronger block, like a C6 427 block or a marine Block. Note: All FE Blocks should be bored and honed with torque plates installed. Bore deflection is as follows.

C8AZ-6010-G	.003"
427 Marine Block	.001 to .002
Thick Walled 390,428	.004 to .006"
Thin Wall Blocks	.006 to .008"

As you can see they all can benefit from torque plates in some cases as much as 80 or 90 HP.

Now for the real story about oil system mods. We will start with the top oiler 332 through 428. First, let's start at the oil pump flange. We will start with a 5/8" Dia. Drill and open up the hole at the oil pump Mtg. Flange. Then using a grinder and carbide rotary file we will port the opening to match the pump.

The next operation is to open up the passage to the filter adapter to ½", using a 3 fluted core drill (A 2 flute will do but you had better have a good hold on the drill motor). Moving right along, the next operation would be to check the diagonal oil hole that runs across the front of the block. It should be 7/16 min. diameter. The main oil passage that runs the length of the block also needs to be opened to 7/16 diameter at least back past the 3rd main bearing hole, and preferably all the way through.

Next inline would be the passages that go from the main oil gallery to the cam journals on the center 3 cam bearings.

With the cam bearings removed, we will use a 5/16 diameter taper length drill through the oil holes in the main saddles. Which are already 5/16. For this operation, we will put a flat or 0" rake on the drill to prevent it from screwing itself into the hole and breaking. This is a good idea for any drill being used for opening up an existing hole. One other bit of prevention would be to take an old main bearing insert and grind off the locator tag, then place it in the main saddles prior to drilling. This will prevent the drill chuck from damaging the main bearing bore. It won't hurt to open up the passages to the front and rear main saddles. However, they only feed one rod each and don't need as much supply as the center three mains do, which feed two rod journals each.

This would be a good time to tap the lifter offshoots from the main oil gallery with a 3/8 – 24 tap. Then a 3/8 – 24 set screw can be used to block off oil to the lifters, should a solid lifter cam be used, or for easy removal, to go back to hydraulic lifters in the future. It is not necessary to block oil to the lifters to run solid lifters, but on the FE it is an option that other make's do not enjoy.

The oil hole at the main bearing on 1, 2, and 4 will need to be chamfered to make the oil hole line up with the hole in the bearings. All of the oil holes that had plugs in them can now be threaded and fitted with pipe plugs, and don't forget the one behind the distributor at the end of the lifter gallery. This is a major cause of low oil pressure after a rebuild. Don't leave it out!

Let's talk about oil systems. We last talked about modifying the block for hi-performance oiling. Now we will go into the rest of the oil system. The oil pump we use for most wet sump applications is the Melling M-57-HV. This is a high volume pump and features a dampening chamber at the end of the relief valve.

The only modifications needed are a check of the clearances and installation of the 100-PSI Spring, which is available at Dove Performance Parts, as well as complete pumps. The specs should be as follows:

Rotor End Play	.002 to .003
Rotor to Housing	.006 to .012
Inner Rotor to Outer Rotor	.005 to .010
Torque Specs for the Cover	95 to 100 in. Lbs.

The relief valve should move freely in its bore and with the relief valve removed inspect the bottom of the bore for manufacturing defects such as metal turnings or other foreign matter.

The use of loctite or safety wire is not necessary unless you're going to run very long distance endurance races. For street engines using hydraulic lifters the 100 PSI spring will cause lifter pump up and limit your RPM. For these applications use the 70 PSI spring that comes with the M-57-HV Pump.

Hot Tip: For class drag and circle track street stock racers, the FE has an unusual ability to run with no oil to the lifters. If the rulebook says you must run hydraulic lifters it probably doesn't say anything about having oil in them. In this case, we will block off oil to the lifters and leave the oil gallery plug out of the front left side lifter passage, drill a small 1/8" hole through the center of the bolt that plugs the front of the right side lifter oil gallery. These modifications are to prevent residual oil from building up at the lifters. The next thing is to remove the small ball or flat check valve from the lifters to prevent any pressure built up in the lifters. Reassemble the lifters leaving the big spring in.

Now you can install your favorite solid lifter cam and set the lash as usual but at the bottom of the lifter travel. The engine now has met the rules but has a solid cam and the technical inspector will be able to compress the lifter and verify to all that it is a legal hydraulic lifter. This trick will not work on other engines that oil through to push rods! FE's one, opposition zero.

Back to the oil system after the oil pump is done the next consideration would be the oil filter adapter. For standard filter location use a COAE-6881-A adapter from Ford or Dove. Ford used their head on this one they substituted the 352 part with the one from a 427 with large, properly contoured oil passages and upon assembly make sure that you don't put the gasket on upside down! If you are using a remote oil filter, then use the Dove-6881 adapter. In both cases place a gasket on the block and modify the gasket to match the oil holes in the block. Then place it on the adapter and blend any mismatch that may be found.

Hot Tip: If you have noticed dirt embedded in your bearings upon tear down, no matter how clean the engine was on assembly, try putting the oil cooler ahead of the filters in the oil system. When cleaning the oiler cooler you will notice that you can clean all day and still find more dirt coming out. By putting the cooler ahead of the filters the cooler dirt you didn't get out (you can be sure there is some) will be stopped at the filters. As for the oil filters, if possible use two filters mounted parallel. This will give less pressure loss and will keep the relief valve in the filter closed, thus, filtering all of the oil.

In situations where very high RPM is used you can route 2 lines from the "out" side of the oil filter adapter on the side oiler engines; one line will hook up at the normal remote oil filter adapter. The other at the rear most side oiler port that goes directly to the rear main at the other end of the main oil passage. When preparing the side oiler block it is desirable to enlarge the pipe thread at this point to take a 3/8 or ½ pipe fitting. However, be very careful not to drill too deep, as the boss looks much larger from the front than it actually is from the rear, or flywheel end of the block. For top oiler blocks the second oil line can be attached at the top rear of the main oil passage. The line can pass through a special cover at the rear breather opening in the manifold.

This system of oil from both ends of the engine does help durability in high RPM long duration races. One example of how much this helps is one 427, in particular, that was assembled with a Ford steel crank with push in plugs in the hollow crank throws. One of the snap ring grooves was improperly machined from the factory. After the engine was run the first day, which consisted of about 100 laps of super-modified racing, we took down the pan to make an inspection and found the plug and snap ring in the pan. We thought the bearings would be ruined, but upon inspection they were perfect. We didn't notice a change in oil pressure, which means the plug must have come out on the initial start up.

The only thing that saved that engine was the oil being fed from both ends of the engine. Now it is two years later and that same 427 is still running strong and beating the Chevy's on a regular basis. We fixed the plug without tearing the engine down and it has never had a head off or a push rod out, it has less than 2% leak down. Pretty good after 2 years of super racing. (Let's see you do that with your Bow Tie!)

As for dry sump systems the most important thing is a good pan with a properly designed tray and oil scraper. The pan must have two totally independent oil pick-ups. One at the front and one at the rear and each one must have its own independent scavenging stage of the dry sump pump. The capacity of the scavenge must be 2 to 4 times that of the pressure stage.

The pressure stage must be large enough to hold 90 to 100 PSI at racing speeds. The oil reservoir must be a large 16-Quart minimum. It takes time to get the air out of the oil. For plumbing on these applications use fittings and hoses that have at least ½" ID at their smallest point. Do not use fittings that make very tight bends. Use mandrel bent tube type hose ends. Solid tight angle fittings have no place in a Hi Performance Oil System!

Block Preparation

Now that we have covered oil system mods and block selection, another option is now available for the block.

The Dove cast Iron Block is finished at last. It features siamese bores, ductil iron main caps, it is a side oiler, and we are happy to announce that the weight is 235 lbs. Only 25 lbs. over the Stock Ford Block and 30 lbs. lighter than the SVO 460 Block.

The bore capacity is 4.375 normally and can go to 4.44 with special head gaskets. This block also uses the same metal chemistry as the SVO Blocks.

This new block makes the 527 CID a comfortable combination, and for those who like to stretch things a little, a 572 CID in SOHC configuration.

This block with it's large bore size capability, combined with the proven Dove Aluminum Block, will provide the perfect base for any FE project.

Let's cover Block preparation. The FE needs very little work to make it perform well and live long but we will still cover the tricks of the trade that make more power. The most noticeable item is the use of a torque plate when preparing the cylinders. This alone is worth from 30 HP on a mild engine to 150 or 200 HP on a highly modified race mill.

The torque plate should be attached to the block with the fasteners and head gaskets of the same type that will be used on final assembly. The threads should be lubricated, preferably with Moly Lube or at least engine oil. The torque plates should be left on for boring and honing and also for all honing of the mains. The main caps should be torqued in place during cylinder honing.

In some extreme cases where the absolute last HP must be found, the heads are installed and a bore gage used from the bottom of the block and the actual dimensions recorded. Then when the torque plate is installed the fasteners are "tweaked" until each cylinder matches the recorded data. In these cases everything is usually bolted to the block just as if it were in the car, such as the bell housing, motor mounts, water pump, main caps, etc... The perfectionist will also circulate hot water through the block while honing it to size.

It is very important to use a torque plate even for a stock overhaul. If your local engine shop does not have one, we at Dove have them available.

For cylinder wall finish use the piston ring manufacturer's specs. For serious endurance racing we use Moly top rings, a ductile iron 2nd ring, and a low tension oil ring. In this case, we use a special series of stones to finish the cylinder walls to a final finish of "4" RMS. When using a finish this smooth you must be very sure of trueness of the cylinder and the accuracy of the rings being used.

In our Super Modified Circle Track Alcohol Engine, after 3 full seasons of competition, we are still seeing leak-down figures in the 2% range. We have one Sportsman Late Model Engine with four seasons on it that checks from 4 to 6 percent leak-down. After seeing the power and longevity of these engines, they are proof that attention to detail in block preparation is worth the effort and time it takes to perform.

When align honing the block, stop when you get to the low limit of the size then install a bearing and check the vertical dimension with an ID micrometer. **Do not depend on this reading**. Take the same micrometer that is used to

check the crank and check the ID micrometer with the OD micrometer. This will give you an accurate comparison of diameters. The difference we are looking for is-- for stock street engines .001" to .002", for high performance street under 6000 RPM .002" to .0025", for endurance circle track, road race, and drag racing .0025" to .003". After checking this clearance we can remove the bearing and finish the main bore to the proper bearing clearance.

If we had just align-honed the block to the factory specs we would have no control over the resulting clearances.

Another factor is variation of the wall thickness on the actual bearing insert. I have seen .010" under bearings clearly marked as such, actually being .020" under. Whether this was an honest mistake or an intentional trick by a Chevy Lover working in a bearing factory, I don't know. Another factor is STD tolerance used to manufacture bearings. So, to prevent trouble, use a micrometer to check all of the bearings for variation. You may have to go through several sets to find what you want. In some cases, you can use the difference you find to make up for variation on crank journal diameters or housing bore variations.

I have seen cases where I would discard a half set of bearings while preparing them, some with minor flaws and occasionally with major flaws. The same goes with rings. What happens when someone slips or makes a mistake end gapping the rings? If he has more on the shelf and is honest, he will get another ring. If he has only one set, he will probably put it in the engine. If the only FE parts in the place are for your engine, then you are in the wrong shop.

Another cause of low oil pressure is the parting line chamfer on the main bearings. This chamfer should not be more than .010" max. A set of bearings with an excess parting line chamfer will cause 20 oil leaks and very low oil pressure.

Installing Cam bearing in the FE

This job on a standard engine may seem fairly straightforward. However, it can be very involved if done properly. The first requirement is that the cam must turn freely. This is seldom the case. The next is that the oil holes must line up in the #1 bearing on top oiler blocks or on the side oiler positioned correctly. Another thing to watch for on side oiler engines is the location of the oil groove on #2 and #4 bearing journals. I use a gage to get a measurement from the front face of the cam to the oil grooves in the cam. We then insert the gage from the front of the block to check the location of the oil hole in the cam bearings. Without this inspection, you might not get oil to the rocker assembly on one or both sides of the engine.

Another thing to take note of is that the side oiler uses a different set of cam bearings than a top oiler block and Dove Iron and Aluminum Blocks use still another.

The side oiler Ford Blocks have 2 oil holes 90 degrees apart on #2 and #4 cam bearings. These holes must line up with the oil passage that goes to the deck to lube the top end. As previously mentioned, they must also match the groove in the cam.

The Dove Blocks use a special bearing with the oil holes in #2 and #4, 140 degrees apart. This is necessary to clear the large cylinders with the oil passage. These bearings can be manufactured from standard FE cam bearings very easily.

Now the fit of the cam. If there is any operation that you should be on hand for this is it. Most engine builders accept the fact that they can not turn the cam very easily after installation. The cam should turn freely with very little effort. If it doesn't, then the cam bearing must be hand fitted. A lot of people do this, but not many are good at it.

At Dove, we have devised a cam bearing installation tool that will install the bearings straight and then a sizing tool that automatically, when pressed through the cam bearings, sets the proper clearance and also sets the depth of the front cam bearing. The use of these tools takes a job that can take all day and reduces it to half an hour. The results are incredible. A properly sized bore that will live and prosper, not a hacked up mess that will only last a short time and cause a loss of oil pressure and inaccurate valve action or in extreme cases a broken cam from excess flex. The proper clearance is from .001" to .003", with .002" to .003" being desirable. This cam bearing installation tool is available for all engines so you must specify application.

After cam installation use a new thrust plate, these are available from Dove or Ford. Be very careful to use the proper length bolts, too long a bolt will shut off the oil to the distributor pilot and cause it to gall up in the bore. In SOHC applications where this plate is not used, a bolt must be installed in the open bolt hole on the distributor side of the cam bore or the oil will run out of the open hole and cause the same problem.

When degreeing the cam be sure to put a load on the timing chain and sprocket assembly by holding the cam stationary from the rear with pins inserted in the 2 holes in the cam or by installing the rocker assembly. Turn the crank in the direction of rotation while holding tension on the assembly, and torque the cam bolt. This technique has been shown to eliminate as much as 4 degrees of error in cam timing.

We found that upon tear down, the cams were not where we put them. When you thought you were running the cam at 102 degrees intake lobe centerline it was actually 106 degrees. This information has proven very useful in the war against the Chevy's.

One last thing, even if you are not using the mechanical fuel pump, install the fuel pump drive anyway. It will keep the cam bolt from loosening up. Also, the drive pin in the cam sprocket must be 1 5/8" long and made from Chrome Moly steel. These are available from Dove.

Connecting Rods

Now that we went over cam bearing and installation, we will talk about connecting rods.

The Ford rods are good, maybe even better, than other stock rods. The best rod for endurance racing applications is the Carrillo Rod. It is the closest thing to bullet proof that there is even though there are other good brands available.

For a high performance streeter or low RPM bracket engine, the standard 390 rod with 3/8" bolts is more than adequate. I know of some super stock racers that run these rods to 8500 RPM with very light weight pistons and properly prepared rods.

The first thing to look for in used rods is their history. If they have been running in a high RPM stick shift car without an RPM limiter stay away from them. Look for rods from a stock hydraulic lifter engine, they will have less stress and fatigue. Have the rods magnafluxed and reconditioned in a reputable shop that has experience with Ford rods. These rods must be honed two at a time to prevent a barrel shaped bore (big in the center). The size should be taken to the flow limit of size. Then a bearing can be installed and the bore size measured and compared with the crank pin size. The rods are finish honed to adjust to the proper clearance. In racing applications where the bore size of the rods is up to the high limit, use a Michigan 77 CB-952-P rod bearing. It has .002" to .003" extra crush built into it and is ideal for such applications.

To assure the correct clearance, use the same micrometer that was used to check the ID and check the bearing size in the rod. At this time, each pair of rods can be fitted to each crank pin.

The recommended clearance are – for a low RPM streeter, use .001" to .0015"; for a high performance street, use .002" to .0025"; for an endurance race engine is .0027" to .003"; and for drag racing use .0028" to .0032".

As for bolts, use a good after market bolt such as ARP that has a recommended torque spec of 50 lbs or over.

If you wish to polish the rods, they must be re-shot-peened. They are shot-peened from the factory and the benefit from polishing may not be as beneficial as once thought.

Be cautious of rods that have been excessively lightened at the small end. Watch for too thin of wall thickness around the wrist pin and on the big end. If the stock removal goes beyond the balance pad into the ribs of the cap it is too much. However, some stock may be removed from in between the ribs as long as you don't go overboard and use some common sense.

The use of LeMans rods should be limited to those who have the time, knowledge, and money to correct manufacturing defects common to rods such as special alignment dowels, special bolts, heat treat checked, and precise sizing of the big and small ends.

At present, the value of a good set of LeMans rods is very high and with the amount of work necessary to make them raceable, it is much cheaper to go to a custom rod such as the Carrillo which will last far longer than any stock rod.

Using stock rods is a little like playing with snakes, sooner or later you are going to get bit!

Barrel Tips

When circle track racing with the FE, even in small CID ranges with a 2-barrel carburetor, there is a special tuning problem. Even a stock FE head will flow more air than a good Chevy head. When the RPM gets up over 6000 we are pulling a lot of vacuum even at wide open throttle. (This closes the power valve at the big end and can burn pistons and causes bad plug readings.)

All the carb books will tell you not to remove the power valve but when the horsepower starts to get up to 400 to 500 you are moving some serious air through the motor. So here is the recipe for a fast holley carb for the 2 barrel class that will still pass tech.

We will start with a 4412 or an 80095 Holley. The 80095 features anular discharge boosters and staged throttles. This is my choice.

The first thing most people do is to remove the air horn. Wrong! DO NOT DO THIS! This modification alone will cost you 35 HP everywhere, low end through top end.

Now that was easy. The next step is to remove the power valve and relace it with a plug, available from Holley. When using the plug it is necessary to increase the jet sizes about 10 numbers. If you are using the 80095 Holley, which is also 500 CFM, you will have to change to the center hung flat bowl from a 4412 Holley. If your class rules do not allow the 80095, then meet with your tech man and show him that this is the same size as the 4412. If he still won't allow the 80095, then have the anular discharge boosters installed in your 4412. This is especially important if you must use a stock manifold. The 80095 is great for mounting sideways due to the staged throttles.

In some cases, if the jet changes don't seem to make any difference in the plug readings, then you must drill an additional ¼' vent hole in the top of the float bowl or cut out a piece of the bowl gasket at the top center. This will stop the effect the high speed air has on the fuel in the float bowl as it passes the original vent tube. This will make the engine easier to tune for maximum power.

The proper jet sizes for both carbs will be in the low to high 80's. If you are already running jets this large with the power valve installed, it means that the power valve is closing at the big end and cleaning up the plugs which hide an over rich condition at the low end, making the car lazy coming off the turns.

ALL RIGHT, YOU HAVE YOUR ORDERS. NOW GO OUT THERE AND BEAT THOSE CHEVY'S!

This info is competition proven!