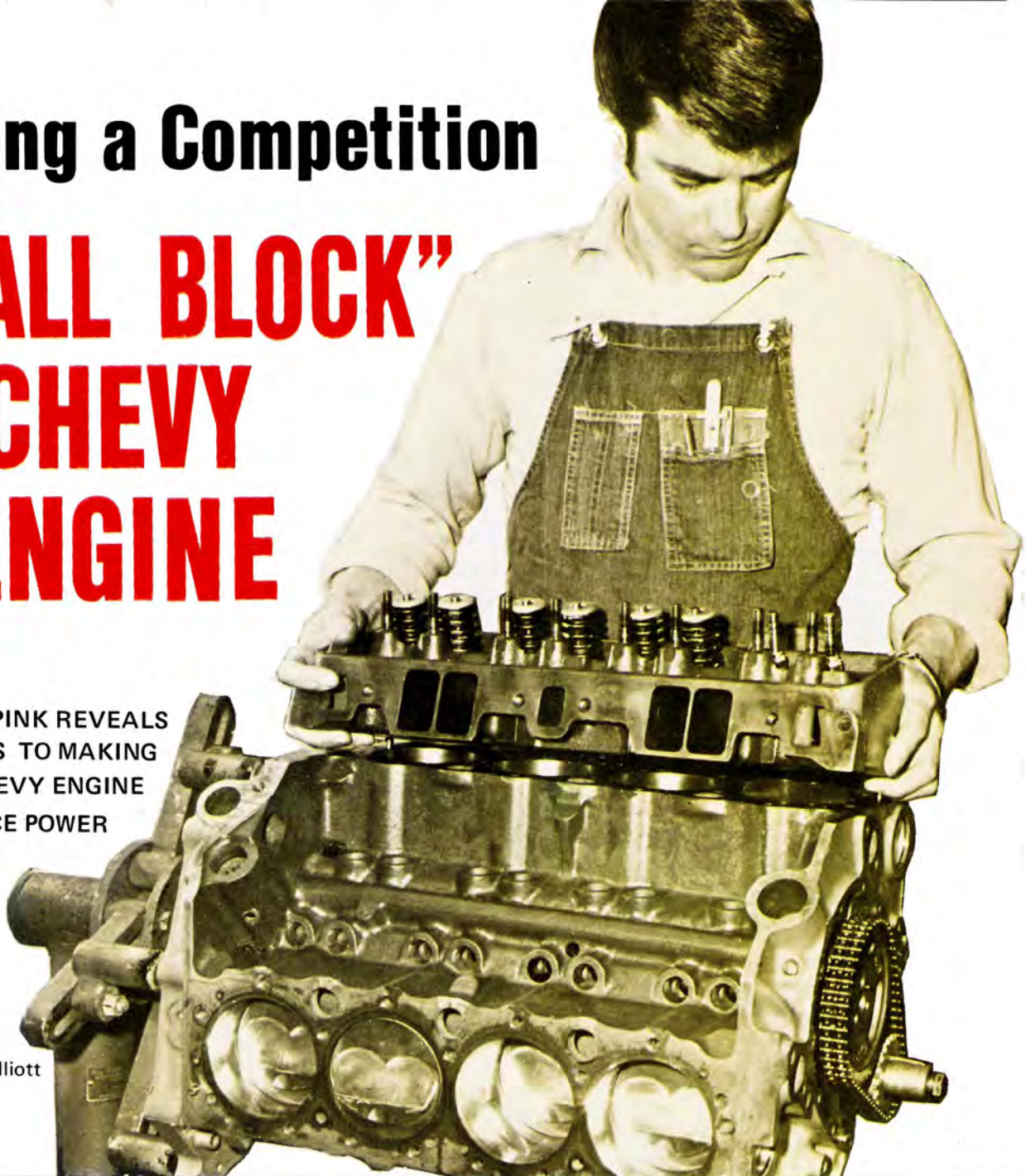


# Building a Competition

## "SMALL BLOCK" CHEVY ENGINE

ED PINK REVEALS  
HIS TRICKS TO MAKING  
THE CHEVY ENGINE  
PRODUCE POWER  
AND STAY  
TOGETHER!

By George Elliott



When it comes to building an engine, whether it be for street or competition, one should strive to get the most from it. One man that does just that is Ed Pink, well known racing engine builder from Van Nuys, Calif. Ed makes a living (and his reputation) by building engines and good ones at that. The reason for Ed's success is his attention to detail in his job. When something is not just right, then he finds out why and corrects it. Some good examples of what we mean are mentioned in this story as Ed reveals the tricks for making the small block Chevy engine successful.

We could call this story the building of a competition engine, but the procedures could also be followed whether your engine is for street or strip. The basic idea is being carried

out on POP RODS's Project X small block engine displacing 292-cubic-inches. About three years ago this engine was built as a street engine using all the budget goodies (July, August and September '66 POP ROD'S). Now, after a very successful performance with the old powerplant, we are rebuilding the engine to a competition stage. And for this we have turned to the Old Master (as Ed Pink is most often referred) and his great crew of employees to perform the job.

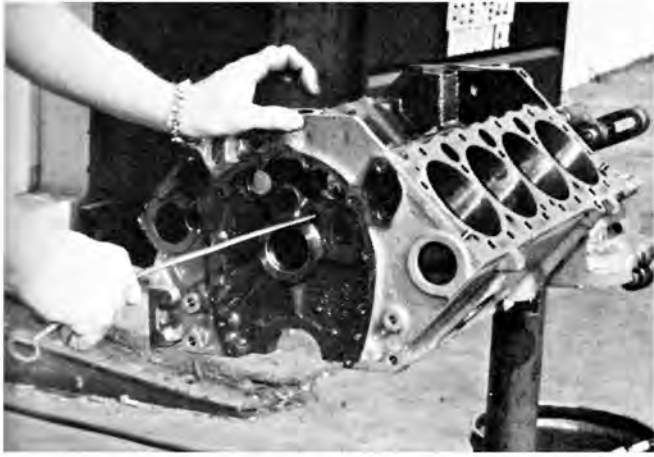
Before starting to disassemble an engine you must have an idea of what you want it to do when it's finished. As for the POP ROD Project X engine being built for this article, the need was for a competition engine—one to run strong on gas with either carbure-

tion or injectors.

We won't go through the detail stage of engine disassembly as the important work for this mill was in preparation of the parts which were going into the block and the actual assembly.

Once the builder has determined the exact use of the engine—mild or all out competition—he orders all the parts. For our engine we used a Crank-Shaft Company Dyna-Rev crank; CrankShaft Co. reworked 327 rods; JE Pistons with an "I" deflector; Ramco Moly Piston Rings; Federal Mogul 3275-AP Rod Bearings, 2nd 994M-AP 10 main bearings; Iskenderian 550 Super LeGerra cam and the Mondello 327 heads which were originally built for the Project X engine.

The parts are laid out so the builder



*Cleanliness is the name of the game. Brushes and solvent are used in the bores, oil passages and all surfaces and then soap and water are used to remove all particles. The decks are lightly burnished with a stone from machine work.*



*Cleaning the CrankShaft Company crank is done with a special brush to get inside the oil passages and radii. Only clean solvent is used here.*



*One trick is the cylinders hone. A 45-degree crosshatch pattern is used. The rougher the hone the quicker rings seat and wear out. Ramco Piston Rings are used on JE Pistons.*

has quick access to everything and can be sure that nothing is missing as the job progresses. But before any work can be started on the assembly of the engine, the block undergoes much attention.

To start with, the block is hot tanked for a minimum period of 24 hours. With our engine the period was longer as sludge was difficult to get out of the tight corners. When the block is back from hot tanking it gets thorough washing with solvents and soap to clear the debris loosened from the hot tank procedure.

The block is washed until all the oil from the inside is gone. All surfaces that don't have moving parts or areas that require a seal (like the deck and cylinders, etc.) are then painted with a Red Rustoleum paint. By doing this

the pores of the block are filled and the oil stays cleaner; bearing dust from something going wrong can be detected easier. BE SURE that the block is free of any oil prior to painting with Rustoleum because it won't bond if there is and can peel loose and possibly clog up the oil pump when the engine is in operation.

Block preparation and machine work can be started at this point with the first check being the deck of the block followed by an align bore check of the mains. A straight edge is laid on the deck (top surface of the block) to see if it is perfectly level without high or low spots. These spots would blow head gaskets because a perfect seal cannot be obtained. Before anything is machined off the block to correct any imperfections, one must be sure that

the deck height is even on both sides of the block. In other words, machine both sides so they are the same height even if only one side is off.

To check the align bore Ed sets a bar through the mains and determines where and how much the mains are off. Essentially the object is to make the mains in perfect alignment and all the main cap bores the proper size so bearing crush is the same on each crank throw. Although it may not sound important, the align bore procedure can mean as much as 500 rpm and the difference between long bearing life and premature death of the units from unequal pressures on the crank.

With our particular engine, we installed Summers Brother Engineering four-bolt steel main caps. These provide two wider main cap support and



*The blocks deck (top surface) is checked by the "young master", Larry Dixon, to see if there is evidence of uneven surfaces.*



*The actual deck is determined by micrometer checks of each piston in the cylinder. The average here was .018. Your deck height is a determining factor for compression ratios.*



*The rear oil main seal groove is center punched extensively to prevent the carbon rope seal from spinning.*



*Again a trick! Drill the oil passage holes out to the same size as those in the block.*



*Debur the bearing carefully and then lightly buff the surface with a "000" grade of steel wool.*

reduces "flex". When installing main caps of this type, the block must also be surfaced on the bottom as most blocks are far from level. The correct mounting height for the outside main bolt must also be machined. Of course, the surfacing procedure is another one of those steps for which the average mechanic won't have facilities (the same for align boring); therefore, a professional engine builder's attention to the matter is recommended.

Once the block is surfaced to the proper specs so the main caps fit into the original cap pads and onto the block surface properly, the alignment of the mains is checked. Material is cut away from the caps to correct alignment because material cut from the block would move the cam and crank centers closer together, making the

timing chain too loose for accurate operation. Again, let a professional handle this job for you.

The cylinders are then bored to the chosen size. Ours (being previously bored to 3-15/16-inch) only required a hone. The hone Pink recommends is a 45-degree cross-hatch pattern with Aamco No. 620 grit stones. This combination has been most successful for Ed when using the Ramco piston rings.

The lifter bores get honed with a brake cylinder hone to scuff the surfaces. Don't get carried away with this procedure as the lifters can cock and stick if the bores are enlarged.

All the bolt holes are tapped to clean the threads so even torque can be obtained. Grease or dirt particles will not let a head or main bolt tighten up properly and can give a false torque

reading.

Wash the block very thoroughly to make it ready for assembly. The decks are deburred with a stone and the oil passages, bores and lifter bores are cleaned with large special brushes to get machine particles out. After a good solvent wash repeat the procedure with a strong detergent soap. One thing you cannot do and that's over clean an engine. And cleanliness is the key to extended part life.

With the block work completed the components for the engine are readied for assembly. This requires double and triple checking of everything prior to and at the time of assembly. Never take a manufacturer's specifications for granted!

To determine the clearances, throws on the crank are measured with



*Ring edges are deburred with a fine grit stone. Eliminates snagging in the ring groove.*



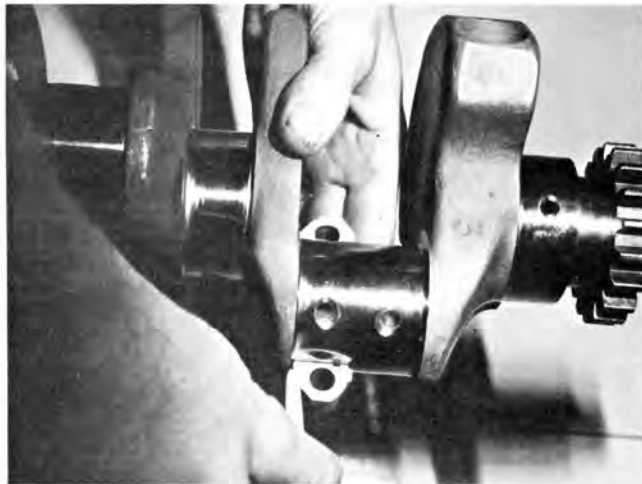
*Ring depth must be checked to assure proper fit. If ring sinks below ring land groove then depth is okay.*



*Lightly sand the pistons with a 320 or finer grit of wet and dry sandpaper.*



*Butt clearance is measured with feeler gauge: Preferred clearance is .024-to-.028.*



*It is important to see that rods and bearings clear the side radius on the crank.*

micrometers and recorded. The same goes for the mains, with the bearings installed, and the difference of the two readings is your clearance. In the mains a clearance of .004-to-.006 is desired. The same clearance is good for the rods. If micrometers are not available then Plasti-gage should be used at the time of assembly so the exact clearances are known.

The pistons are miked at the opposite sides of the pin below the oil ring. After miking the cylinders, the piston wall clearance is the difference of the two.

The rods are measured on the width of the big end, and on the crankshaft a rod throw is measured. The total of two rods' width and the difference from the throw will be the lateral or side clearance. This is easily double-

checked after assembly with a feeler gauge put between the rods.

The rings are installed inside the cylinder and squarred. The end clearance is checked with a feeler gauge and should be between .024 and .028.

To check the piston ring groove depth set the ring in the ring land. If the ring fit down below the surface, the depth is adequate.

Basically the engine is ready for assembly. But before the bearings are installed in the block to receive the crankshaft, there are two procedures to be followed. First, match the oil passage holes, in the block to that in the bearing. Usually the bearing holes are slightly smaller and by enlarging them to the block size oil flow is improved. Next deburr the bearing and remove nicks or scuffs with a "000"

grade of steel wool. Wash the parts thoroughly along with the crankshaft prior to installation.

The rear oil seal in the small block Chevy is a carbon rope type. To insure that it doesn't spin after being installed a center punch is used to rough up the mounting area which will provide a grip for the rope.

A special note of a possible problem should be pointed out here. If you install the crankshaft and it won't turn freely then the rope may not be seated deep enough in the groove. Make sure that the seal is as deep as it can go before trimming off the ends with a razor blade. A ball peen hammer can be used to tap the seal into the groove. Should the crank still be hard to rotate after installation and you are sure the rope is deep in the groove then the



A major change to the engine's lower end was the addition of Summers Brothers Engineering four-bolt main caps. Sealer is used on the outside bolts as they enter the water jacket. Special block surfacing should be done prior to installation.



A dual chain timing gear sprocket is used in place of the stock single chain unit. Here, holes are being drilled out so offset bushings can be used to bring cam timing to desired specs.



The JE Pistons are put into place after special attention to the piston and rod assembly has been carried out. Ring compressor used is manufactured by Pink in all bore sizes.



Torque on the bolts, of course, is important. Bring torque up gradually until exact readings are obtained.

crank flange may be hitting the main cap and might work. This was found to be the case on our engine where we had align bored it so many times, lowering the main cap to where the flange actually hit the cap.

Many amateur engine builders may overlook the problem and view it as just a tight fit. Here is where Pink's example applies: if something doesn't feel just right find out what is wrong and correct it!

When installing the crank and bearings lubricate them with a 50 or 60 weight oil. Ed personally uses Valvoline for all his engines. The parts are rotated many times before the engine is completed and this protects the bearings sufficiently.

The rod and piston assembly can be

done now. As previously mentioned the rods we are using are CrankShaft Company reworked '65 Chevy units of the 327-inch engine vintage. SCS magnifluted the units, polished the forging ridges off the "I" beam and installed larger bolts for high performance use. The radius at the bolts is increased to relieve stress and the rods are also shot peened for stress relief.

Pistons are the JE Super 500 series with the "I" deflector. The "I" deflector means that with cylinder heads of 68cc. volume the compression ratio would be 11.6-to-1. With the 62cc. head compression would be 12.8 and with a 60cc. head the ratio would be 13.3. This is based on a .020 deck height and a .020 head gasket. JE stocks pistons of higher and lower

deflector designs for the same bore size, or for that matter up to 4-1/16-inch bores.

When installing the pistons on the rods to be sure of the cylinder they are going into. The valve pockets are placed up in the cylinder and there is an oil hole on the rod big end that should be pointing toward the cam. When putting the snap ring that holds the piston pin in place watch for a sharp and a slightly rounded edge. This is only caused from the way a snap ring is manufactured, but the sharp edge should be facing out for maximum grip.

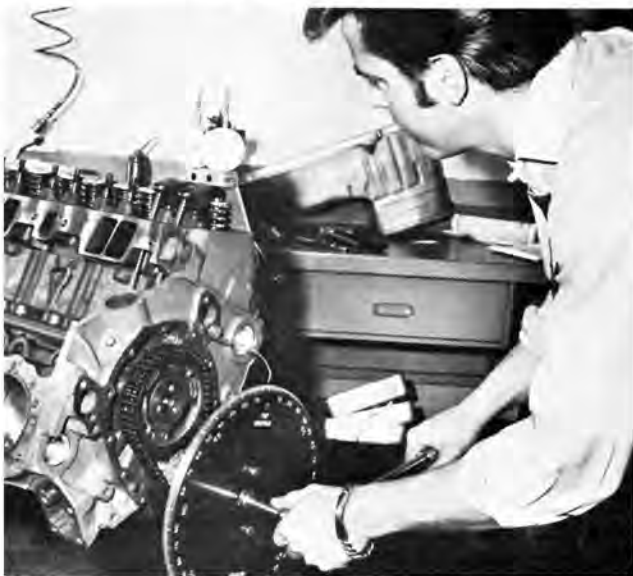
Installation of the Ramco piston rings is achieved by putting the oil ring on first, which, of course, is the bottom ring. Ramco's oil ring is an



*Side clearance is measured as is the thrust clearance. All is important to assure no binding will occur.*



*Valve clearance is important as the valves could come in contact under high rpm runs. If that happens it's curtains for the engine.*



*Degreeing in the camshaft is very important and time consuming. We're using the Iskenderian 550 Super LeGerra with offset buttons to slightly advance the cam.*

expander type with two rails, one on top and one on the bottom of the expander. When putting the expanders on make sure they rotate freely. The top and bottom rails should have the openings spaced away from each other about one inch. On the second ring the inside has a taper. The taper should be pointing up. The top ring has a ridge and that also points up.

Oil the piston heavily before installing it in the cylinder. Pink makes a super neat piston installation tool. It eliminates the standard problem of breaking rings because the ring compressor slips off when the piston is being installed.

As the piston is being installed guard the crank. The rod bolts could

seriously scar the crank if they hit it. Rubber hose is a good method of protection.

As the assembly progresses keep double checking. The deck height can be double checked to make sure you reached the height wanted as soon as the first piston is installed.

Don't hesitate to take the engine apart again if everything is not just right. Pink believes strongly about this and that's just another of his secrets to a good engine.

Once the engine has been short blocked, the cam can be installed. However, before the installation, drill the timing gear holes out so offset buttons can be used. Drill size and

*Continued on next page*

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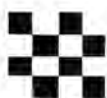


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buttons are available from Isky. We also went to a double link timing chain which is available from Chevy under number 3735411.

The main reason for offset buttons is that the timing of a cam can be slightly off from the recommended specs. The buttons, of course, can correct this.

When installing the cam be sure the cam timing gear marks and the crank gear marks are together. Ed then installs a degree ring and dial indicators and proceeds to check all the cam specs against those of the manufacturer. The procedure is important for more reasons than one. First, if you ever have to replace the cam and the engine was really running good you may not get another cam exactly the same as the previous one. By knowing where the timing was to begin with, you can degree the new cam into the same settings. Pink commented that one of the biggest problems with hot rodders is that they don't even know where their engine is and therefore, when something doesn't perform well, they don't even know where to start looking to correct the situation.

Cam specs on the Isky Super LeGerra 550 grind are: lift, .540-inch; duration, 330 degrees; intake opens 57 degrees before top dead center and closes at 93 degrees after bottom dead center while the exhaust opens at 93 degrees before bottom dead center and closes at 57 degrees after top dead center. When degreasing in your cam take the readings from the valve.

Another check in the valve train is the clearance between the two valves. If you are using stock heads then this won't be any problem; however, if larger valves have been installed, be sure that there is at least .060-inch clearance between them. This eliminates the chance of the valves contacting each other when they expand from heat or happen to float.

The heads are torqued in place following a pattern where the bolts are torqued evenly. A *Motor Manual* is a good place to see the bolt pattern to follow.

One more detail needs attention for the competition engine. That's the oil supply system. The oil pump used in our engine is that of a Corvette. The cap should be removed and the gears checked for freedom of rotation and that no burrs are on the gears. Also, braze the pickup tube to the pump as these have come apart in the past.

Modifications to the oil pan should primarily consist of a deep sump. Don't forget when you drop the sump in an oil pan that you must also drop the oil pickup.

Overall, the real secret that Ed Pink recommends to building engines is devoting detailed attention to every part and its assembly. When it isn't right, double check it! Always! You'll discover something is definitely wrong and it's better to solve it before and have a perfect and reliable engine than it is to have the engine blow up to point out your mistake!

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