Stroking a Vintage 327 to 383 CID

by Joe Randolph

Like many members of my local NCRS chapter, I painstakingly restored my 1967 Corvette to NCRS standards over a period of several years. The car progressed through the NCRS judging at the chapter, regional, and national levels, culminating in a 98-point Top Flight at the 2007 NCRS National. That was an enjoyable learning experience that I am glad to have had, but after the 2007 convention, I wasn't sure what to do next with the car.

I decided to return to my hot-rodding roots and make modifications that would make my Corvette more fun to drive. However, my NCRS background had given me a serious case of NCRS disease that caused me to place a very high value on original appearance.

So I placed strict limits on what sort of changes would be acceptable. My first criterion was that any changes to the car had to be strictly bolt-in that could be easily reversed by me or a future owner. The second criterion was that the car had to retain the appearance of an original car, even to a casual NCRS observer.

The first change was to install a 5-speed Tremec transmission. As a pure bolt-in change, this was a very worthwhile modification consistent with the criteria I had established. My next challenge was that the original 327-300-HP engine was not as powerful as some other small blocks I had owned. In addition, I found that I was reluctant to run my stock engine very hard, for fear of putting a rod through the side of that valuable original block. The solution I decided on was to install a more powerful small block that had the external appearance of a 1967 L79 327/350 engine. The original engine would be removed and safely stored.

Visible Characteristics of Original 327 Blocks

The simplest way to approach my project would be to buy a crate short block of 350 or 383 cubic inches and dress it as an L79 with period-correct intake, water pump, heads, and valve covers. In fact, aftermarket blocks (such as the Dart Little M) with their larger-bore sizes can be configured for displacements up to 427 cubic inches. (Admittedly, a 427 small-block Corvette does have a certain appeal!) This is the type of approach that any normal person would use to get more power from a stock-appearing small block.

However, having the NCRS disease caused me to obsess over the small visible details that would be different if I used a modern block:

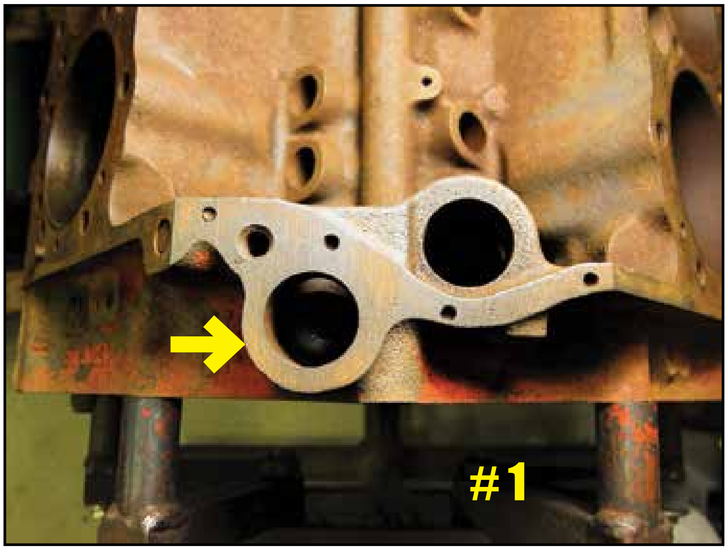
1. The crankcase vent opening at the rear of the Chevy small block was eliminated after 1967. (see Figure 1) The missing vent opening on a newer block would make it difficult to retain the unvented 1967 valve covers and maintain a stock-appearing PCV system.

2. Newer blocks use a spin-on oil filter, rather than the canister-type used in 1967.

3. The dipstick on many newer blocks is on the passenger side, rather than the driver side.

4. The casting number, casting date, and pad of a newer block would not be NCRS correct.

In view of the above, I decided to base the replacement engine on a 1967 block that had all the correct visual features, including a correct casting number, correct casting date, and original broach marks on the pad.



Crankcase vent hole in 327 block

The only clue that the engine was not original to the car would be the numbers stamped on the pad. Even in formal NCRS judging, this would result in only a 50-point deduction out of 350 points for the block and 4500 points total for the entire car. Since I still had NCRS disease, this minimal deviation from original appearance pleased me. I acquired a correct 3892657 block from a Camaro for $300.

No Replacement for Displacement

Hotrodders have coined the phrase, "There's no replacement for displacement," so with this in mind I set out to determine how much I could increase the displacement of a vintage 327.

Since these blocks cannot generally be bored more than .060 inches, I decided to stick with a .030 inch clean-up overbore and focus my attention on the stroke.

Both the Chevy 327 and 350 CID engines use a 4.0 inch bore. The 327 has a 3.25 inch stroke and the 350 has a 3.48 inch stroke. Many people have successfully put a 350 crank in a 327 block, converting a 327 to a 350. The principal change that has to be made is to turn down the 350 crankshaft main journals to the 2.30 inch diameter used by the 327, compared to the 2.45 inch diameter used by the 350. This was my initial plan.

However, with some minor clearancing of the block, a typical 350 can have its stroke increased to 3.75 inches, which results in a displacement of 383 CID when combined with a 4.030 inch bore. This is a very popular modification for the Chevy 350 engine, and parts for the conversion are widely available. I began to wonder whether the stock 327 block had enough room to accommodate a 383 stroker crank.

Some internet searching turned up little information about whether a vintage 327 block could be stroked to 383 CID. After all, most normal people would be inclined to start with a newer 350 block to build a 383. Only someone with NCRS disease would be interested in basing a 383 on a 327 block. Ultimately I determined that it is possible to stroke a vintage 327 to 383 CID, and the notes that follow describe the process I used.

Regarding the adage, "There's no replacement for displacement," fellow-NCRS member Duke Williams told me that it depends on whether your goal is *peak* power or *average* power. The Similar Engine Theory developed by the late Prof. Charles Fayette Taylor provides some useful insight into the effect that displacement has on torque and horsepower.

Taylor's analysis suggested that two engines which are otherwise identical except for stroke (meaning that one will have larger displacement than the other) will generate nearly identical *peak* horsepower. The only difference is that the lower-displacement, short-stroke engine will develop its peak horsepower at a higher RPM. I suspect that this is one reason that the 1968 Z28 302 was generally competitive with the high-performance 327 and 350 engines of that period. The 302 produced similar peak power but at a higher RPM.

In other words, if my only interest was increasing the peak horsepower of my engine, there would be no incentive to stroke it for larger displacement. I could just change other things such as the cam, heads, intake and exhaust to increase peak power, in exchange for the power peak occurring at a higher RPM. However, in Taylor's two "similar engines," the one with the longer stroke will generate more torque than the short-stroke engine, and this benefit will appear throughout the useable RPM band. This translates to more average horsepower over the useful RPM range.

So, the larger displacement engine will have more available horsepower at any RPM below the power peak. An additional benefit is that the larger displacement engine will generate its peak horsepower at a more useable RPM (say, 5500 RPM instead of 7500 RPM). Yet another benefit is that for an identical amount of peak power, the larger displacement engine will have a smoother idle and will be easier to drive on the street. So, in terms of street driving where the engine is seldom operating at the RPM required for peak power, there's still "no replacement for displacement."

The 327 Block Used in 1967

Interestingly, the 3892657 block casting used for the 1967 Corvette 327 was also used for Chevy's very first 350, installed in the 1967 Camaro RS. GM simply machined the same raw block casting for the larger 350 main journals and installed a 350 crank. This convinced me that my 327 block had a good chance of being able to handle a 383 stroker crank. In addition, this meant that if I wanted to, I could have my 327 block line bored for the larger 350 main-bearing journals, so that it could accept an unmodified 383 stroker crank. This is the path I eventually settled on.

327 Blocks Used for 1963-1966

Before I describe how I stroked my 1967 block for 383 CID, I want to address the question of whether a 1963-1966 327 can be stroked to 383 CID. The answer appears to be yes with two caveats.

Out of curiosity, I acquired a 1964 block casting number 3782870 and carefully compared it to my 1967 casting number 3892657. It appears that the available space for the crank and rods is almost identical. The first difference is that some very shallow clearance notches that appear in the 1967 casting (see following text and photos) are not present in the 1963-1966 blocks. So, slightly more material has to be removed to clear the rod bolts in a 1963-1966 block, but the required clearancing remains quite small. The second difference is that the 1963-1966 block castings have less material around the front main bearing. I would not recommend line boring a 1963-1966 block to accept the larger 2.45-inch main-bearing journals used in the 350 blocks. A

383 crank installed in a 1963-1966 327 would have to have the crankshaft main journals turned down to the 2.30 inch diameter used by the 327 blocks.

It's All About the Rods

If you simply install a 383 stroker crank, rods, and pistons in an unmodified 327 or 350 block, there will usually be some clearance problems that prevent the crank from rotating completely. The crankshaft counterweights typically clear the block with little or no clearancing, but the rods almost always have some interference problems.

With reference to Figure 2, point A on the rod usually hits the outside lower edge of the cylinder bore, while point B sometimes hits the inside lower edge of the cylinder bore and can also hit certain lobes on the camshaft. Many builders of 383 stroker motors simply grind enough off the block to clear the stock rods, and grind enough off the stock rod bolt head to clear the cam lobes. However, this is not the method I recommend.

A better approach is to purchase an aftermarket rod that has a so-called "stroker profile" as shown by the rod on the left in Figure 2. The stroker-profile rod typically reduces the block interference problems at points A and B, and for most cams, it completely eliminates potential cam clearance problems at point B. With an appropriate stroker rod, fitting a 383 rotating assembly into a 327 block requires only some very minor clearancing at the base of the cylinder bores.

Comparison of stock rod and stroker profile rod

Selecting a Stroker Profile Rod

The term "stroker profile" is used by the aftermarket industry to describe a rod that provides additional clearance for stroker applications. However, the additional clearance provided by most stroker profile rods is focused on Point B in Figure 2, which helps primarily with cam clearance. Surprisingly, some stroker profile rods provide very little relief at Point A in Figure 2. This is the part of the rod that determines how much clearancing is necessary at the outside lower edge of the bore.

I used the Scat Pro Comp rod shown in Figure 1, and it turned out to be a good overall compromise between clearance at Point A and clearance at Point B. While writing this article I became curious about whether another rod choice might have been better at Point A. So, I purchased samples of five other rods that looked promising. It turned out that the Manley Sportsmaster rod and the Scat Pro Stock rod each provide an additional .010 inches at Point A using the bolts they come with. However, for the Manley rod this additional clearance can be increased to .040 inches by substituting an ARP rod bolt that has a lower profile bolt head. This type of low profile bolt is what the Scat Pro Stock rod comes with.

In summary, the clearance at point A can be improved over the rod that I used, although the clearance at point B is harder to evaluate without having a cam to test with. The question of which rod would be the best overall choice depends on the specific block and cam being used. For a proposed 383 build where the goal is to minimize the amount of block clearancing needed, it might be worthwhile to purchase one each of some candidate rods and compare them using the actual block. Additional cam clearance at Point B, if needed, can usually be achieved by some minor grinding of the rod.

Having gone through the process of clearancing a 327 block for the 3.75 inch stroke of a 383, I cannot overemphasize the importance of using the best stroker-profile rod that you can find. Using the right rod makes the clearancing task significantly easier and greatly reduces the chance of hitting the water jacket when clearancing the outside lower edge of the cylinder bore.

Clearancing the Block

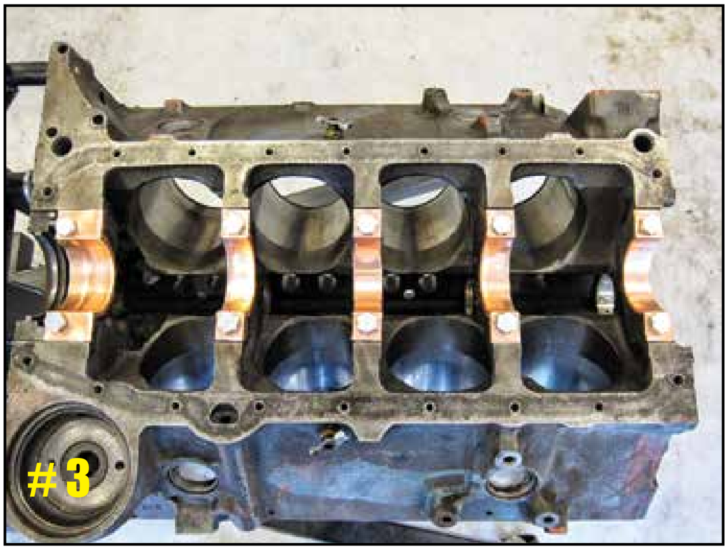
Some machine shops have computer-controlled CNC machines that will do a generic clearancing for a 383, but I do not recommend this for a 327 block. The CNC programs usually remove a lot of material so that even stock rods can be used. I recommend using a stroker-profile rod and then clearancing the block by hand, so that only the absolute minimum amount of material is removed.

I decided to do the clearancing of the block myself, and it was remarkably easy. All I needed was a carbide grinder bit for my drill and a method for installing the 383 crank and a sample rod/piston assembly in the 327 block. I could then rotate the crank by hand and see the places where clearancing was needed. Many engine builders recommend a minimum clearance of .050 inches, while others say that even .025 inches is sufficient. I decided to provide .050 inches, but after completing my build, I did some analysis and concluded that .025 inches is probably fine. Note that the smaller clearance would require less grinding and less risk of hitting the water jacket.

Since I had decided to use a 383 crank that had the larger main journals of a 350 crank, it was not possible to simply install my new 383 crank in the stock 327 block in order to facilitate the clearancing operation. To correctly install the 383 crank, my 327 block would first need to be line bored for the larger 350 main journals.

This created a small dilemma, since I wanted to have the block professionally cleaned after the clearancing operation, but I could not do the clearancing until the block had been line bored at the machine shop. To avoid having the block make two round trips to the machine shop, I devised a method for putting the 383 crank in the correct position in my unmodified 327 block.

It turns out that with the bearing inserts removed, the main journals of the stock 327 block are just slightly larger than those of a 350 crank. So, I lined the block side of the main bearing journals with soft copper as shown in Figure 3. This allowed me to lay the 383 crank in the block and proceed with my clearancing task. I modified an old piston to work with my new crank, and carefully clearanced one cylinder at a time. When I eventually took the block to the machine shop for line boring and cylinder boring, the clearancing had already been done.

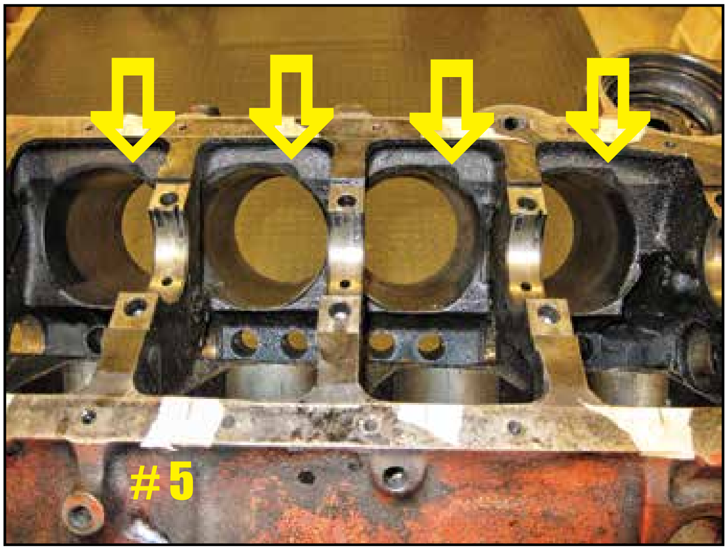


Copper lining of bare main journals to allow 383 crank to be placed in block during clearancing

Figure 4 shows two inexpensive ways to use a carbide bit for the clearancing operation. The electric drill works well, but its size makes it difficult to reach the inside lower edge of the cylinder bore. The smaller pneumatic tool is better at reaching that area. Whichever tool is used, speed control is important. I found that lower speeds created less chatter and kept the cutting speed to a more controllable pace.

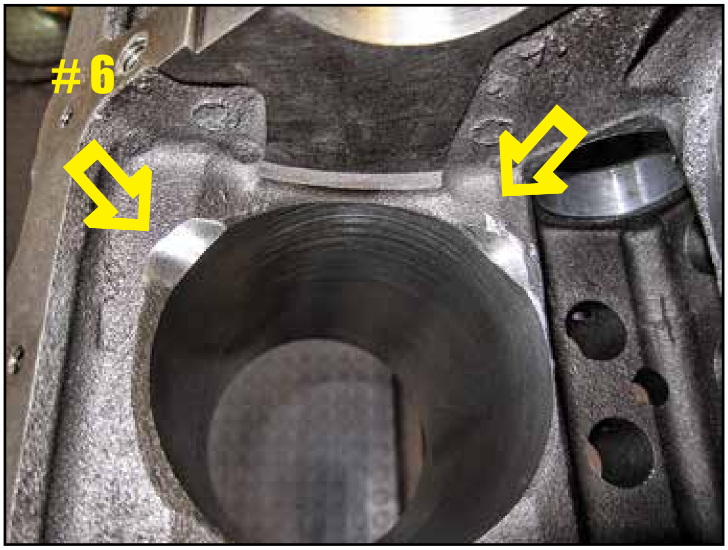
Tools to use with carbide bits

Figures 5 and 6 show the before and after clearancing of the block. Note that GM had already placed shallow notches in the 1967 block (indicated by the arrows in Figure 5), anticipating the longer stroke of the 350 that was based on the same casting. These shallow notches are not present on



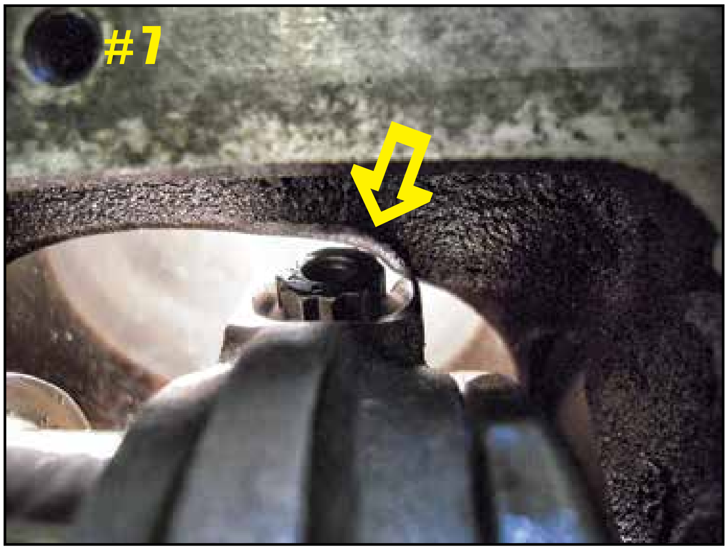
Block before clearancing

the 1963-1966 blocks, so slightly more material needs to be removed in this area when using a 1963-66 block.



Block afterclearancing

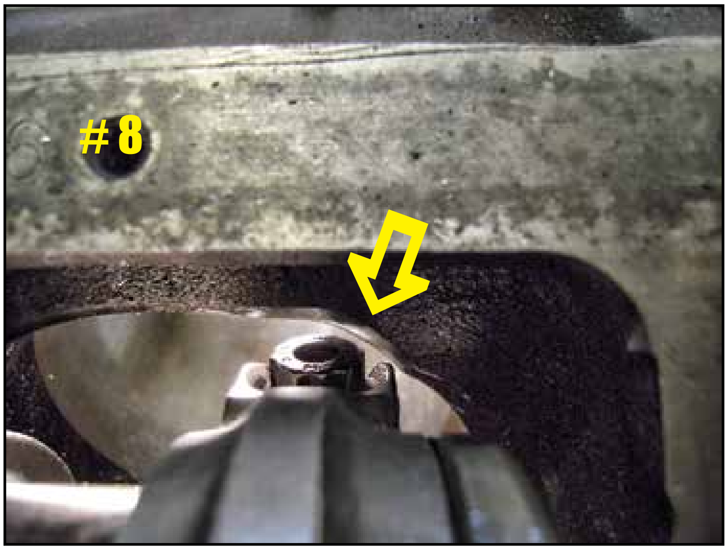
Figure 6 shows the amount of clearancing that I had to do to get adequate clearance at the bottom of the cylinder bore. Figures 7 and 8 show the before and after clearance of the rod bolt at the outside lower edge of the bore. It is clear that only a small amount of material had to be removed. It is also apparent that if the Scat rod did not have the ridge around the bolt head, even less material would need to be removed from the block. One option would be to grind the ridge down slightly. Another option would be to use one of the other two rods mentioned above, since they do not have this ridge around the bolt head.



Rod clearance before grinding

Clearance Between the Rods and the Cam

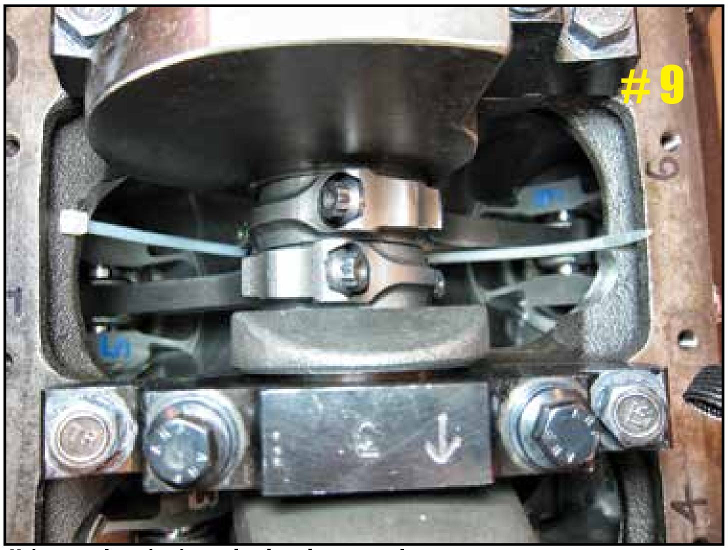
It is important to also check for possible interference between the rods and the cam. Due to the fixed phasing between the



Rod clearance after grinding

crank and the cam when the timing chain is installed, only certain lobes of the cam come close to the rods. The available clearance will depend not only on the rod, but also on the cam's lobe profile. So, cam clearance has to be checked with the intended cam installed along with the timing gears and timing chain.

During my initial clearancing, I used an available L79 cam that I had on hand. That check showed no cam clearance issues whatsoever. However, the actual cam I was using in my build was a roller cam with more lift and duration than the stock L79 cam. After I purchased the roller cam, I decided to re-check the cam clearance with the actual cam I was using, and I'm glad that I performed this check. With the roller cam, I had less than my target .050 inch clearance on a couple cam lobes. All it took to fix this was some very light rounding of one edge of the Scat rod near Point B in Figure 2.



Using a nylon zip tie to check rod-to-cam clearance

In contrast to checking the clearance between the rod and the block, checking the clearance between the rod and the cam is very challenging. The area of interest is deep inside the engine and hard to see. Figure 9 shows how I used a .050 thick nylon zip tie as a gauge for checking the clearance between the rod and the cam. I rotated the crank in very small increments and repeatedly checked to see if the zip tie moved easily through the rod-to-cam gap. This same use of a zip tie helps with the block clearancing as well.

Completing the Short Block Assembly

Figure 10 shows a bottom view of the completed short-block assembly. Note that I opted to have 4-bolt mains installed on the center three main journals. This was an inexpensive addition because the block was already being line bored for the larger main journals of a 350 crankshaft.

Bottom view of completed short block

Figure 11 shows a top view of the completed short block. Aside from the incorrect stamping on the pad, this short block assembly with casting number 3892657 is externally identical to a stock 1967 L79. With the engine assembled, it will be impossible to detect that the engine actually displaces 383 cubic inches and has a roller cam and 4-bolt mains.

While this approach is more time consuming than simply purchasing an assembled 383 short block that was built from a 350 block, the end result is identical in terms of power production. The benefit for someone with NCRS disease is that the end result closely maintains the external appearance of an original 1967 327, all the way down to the crankcase vent at the back of the block and the stock PCV system.

Top view of completed short block

Intake, Exhaust, and Heads

This article has focused on just the short block assembly of my stealth L79 project, but the intake, exhaust, and heads will have their own stealth features that I hope to document in a future article. For these components, the operating theme is the same, which is to maintain the external appearance of a stock 1967 L79 engine, while making significant performance improvements internally. My target is to have the resulting performance be comparable to GM's ZZ383 crate engine, rated at 450 HP and 449 ft.-lb. of torque. This is an ambitious goal, but I think it is achievable.

Summary

With no other changes to the engine, stroking a 327 to 383 CID can easily add another 60 foot-pounds of peak torque and significantly increase the average power over the useable RPM band. In particular, the added torque at low RPM makes the car feel more responsive to drive on the street.

To get the maximum benefit of the additional displacement, other changes would need to be made to the intake, heads, and cam, but making these additional changes is optional. Even without these, the increased displacement will result in a noticeable increase in average power.

I have described a way to maintain the external appearance of a correct, original 327 while gaining the benefits of the additional displacement. The choice of a suitable connecting rod is the key to minimizing the amount of clearancing that is needed.

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