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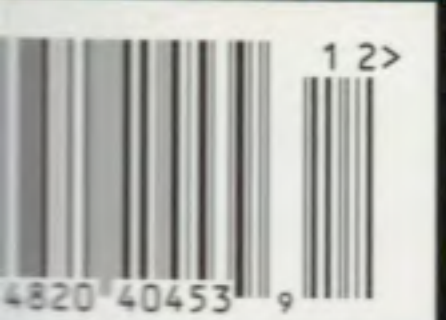
STREET LETHAL



**SMALL-BLOCK
ENGINE LEAK
PREVENTION**

**HOW TO PROPERLY
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9 TIPS FOR A SUCCESSFUL LS BUILD



PREVENT THE LEAK

HOW TO MINIMIZE **DRIPS** WITH THE SMALL-BLOCK CHEVY

The one thing that you quickly learn when working with the small-block Chevy is that they all leak. When this engine was designed in the early 1950s, all engines leaked oil. The joke is that if your small-block stops leaking, it's probably out of oil. Leaks were a fact of life. Automotive engineering has come a long way since those days but the fact remains that this little small-block is still prone to marking its territory with light brown oil stains on the garage floor.

This story will address how to minimize these bouts of leakage. Notice that we didn't try to claim to eliminate those leaks. In the name of full disclosure, we'll stick with minimizing these drips and brown puddles.

We'll start with the oil pan area since that's where many of these drip paths begin. The big gorilla in the room is the classic, two-piece rear main seal. Many of the ideas forwarded in this story are retreads of common repairs and improvements that, over the years, have been proven to work. Veteran readers may recognize many of these, but we've also pulled up some new ones that are worthy of consideration.

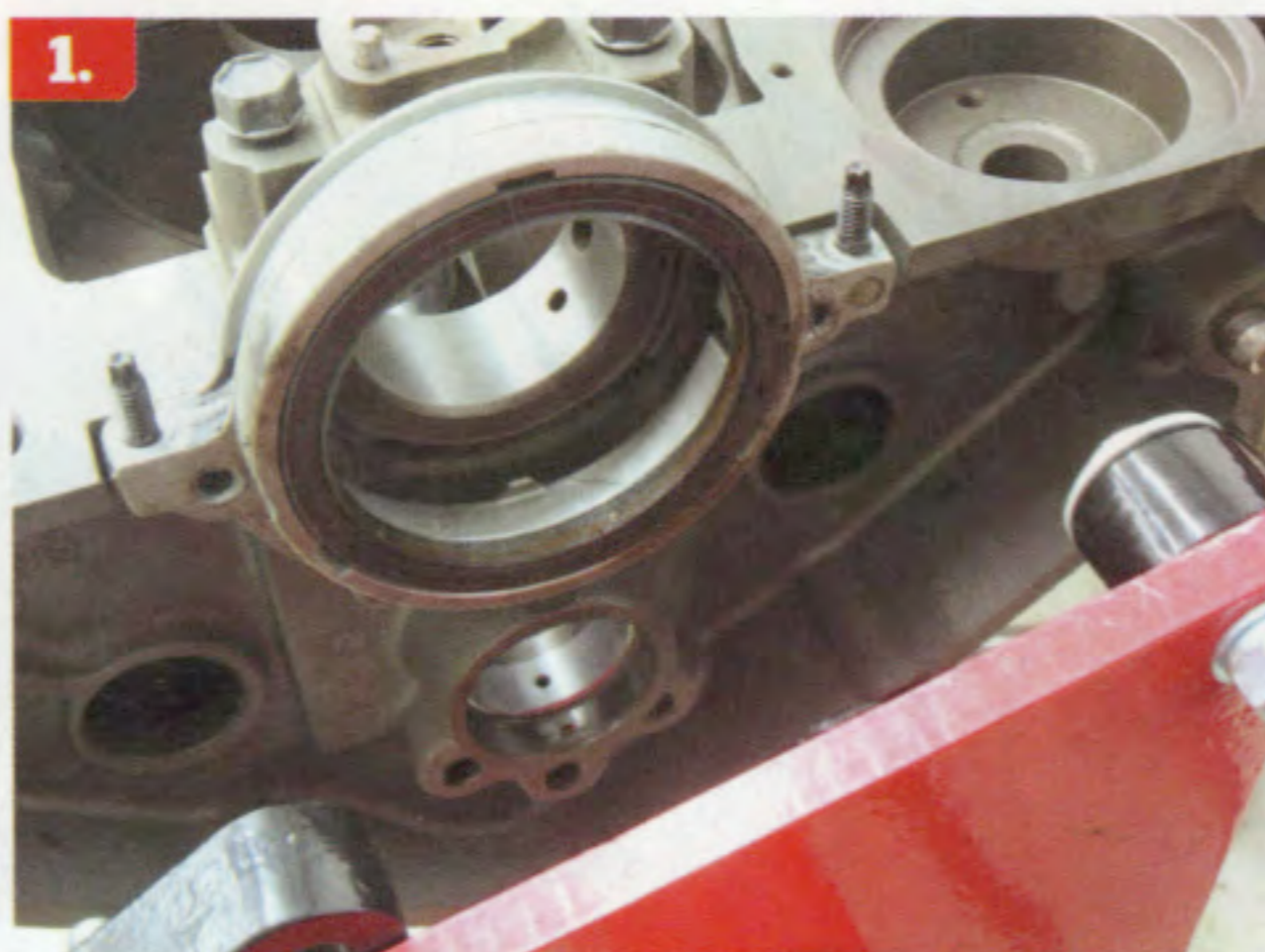
The small-block has benefitted from several evolutions with regard to the classic two-piece rear main seal. We'll use Fel-Pro references for

most of our gasket and seal recommendations since this company offers the greatest number of options. As an example, we found four different two-piece rear main seal part numbers and these point to advancements of different materials from black rubber to the classic blue silicone seals to the brown, fluorelastomer seals all aimed at the traditional 350-style engines. The price differential for these is broad, indicating the difference in quality, so there are plenty of options from which to choose.

Other tricks with the two-piece rear main seal start with offsetting the seal parting lines so they do not line up with the parting lines of the main cap and block. Other tricks involve using an anaerobic sealant between the main cap and the block. Anaerobic sealants cure in the absence of air and a light coat here can be helpful.

Another step in the right direction is to use one of Fel-Pro's one-piece pan gaskets to replace those cumbersome four-piece sets. There are individual one-piece gaskets for the several different iterations of two-piece rear main seal blocks where the dipstick moved from the driver side to the passenger side and also for the one-piece rear main seal blocks. Another trick is to place a small dollop of RTV in each corner of the block to help seal where the pan and front covers come together.

1. When choosing a small-block to rebuild, consider using a one-piece rear main seal block as a potential candidate. Not only do these blocks employ the more-ideal one-piece rear main seal, but they also offer the advantage of using a factory-style hydraulic roller camshaft valvetrain.



2. One no-cost trick when building a two-piece rear main seal engine is to offset the rear main seal so that the parting lines between the seal, main cap, and the block do not line up. Also place a small dab of RTV on both ends of the seal to block that leak path.

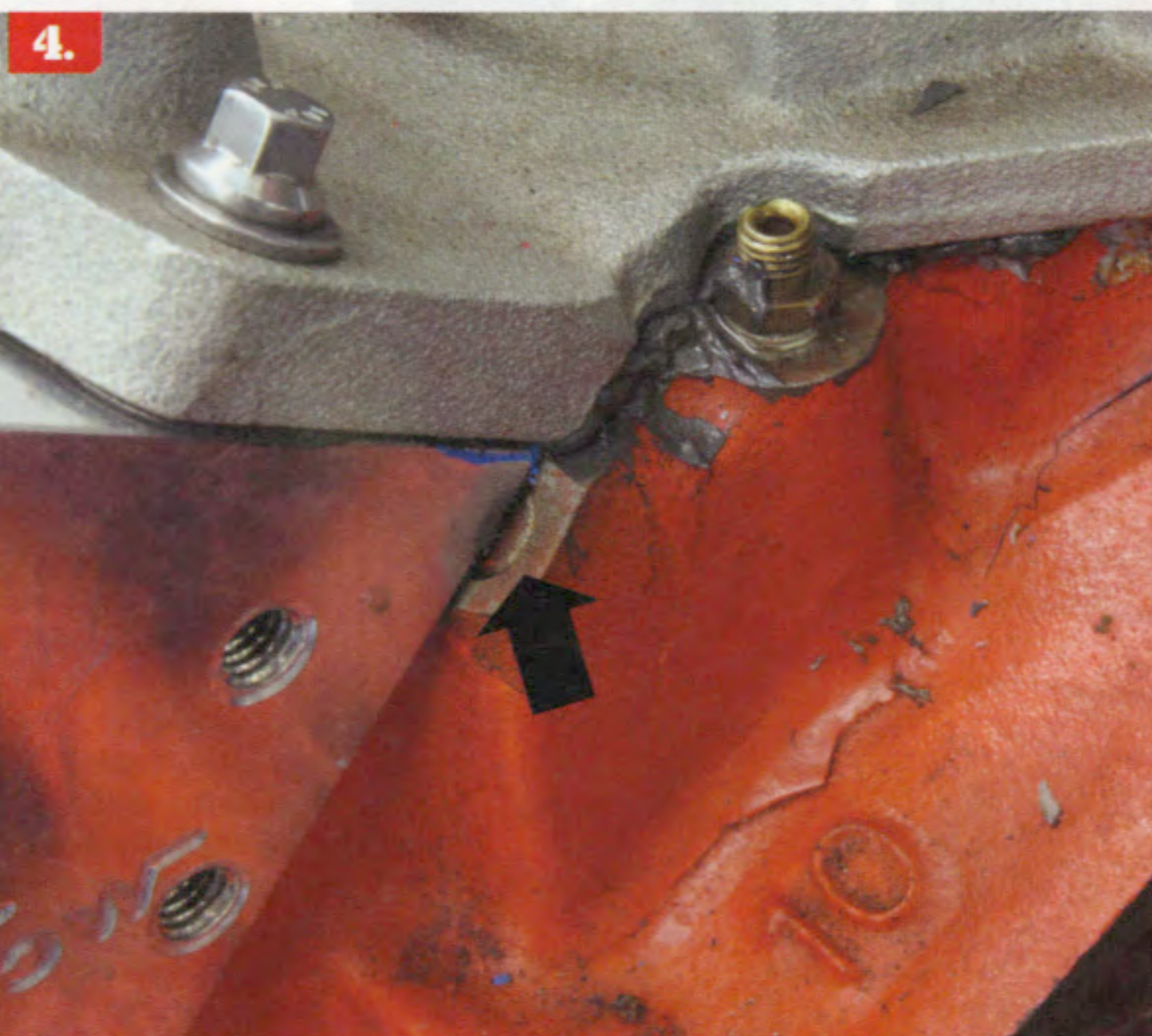


We've suffered from oil leaks between the oil pan and all different oil pan gaskets, especially between the pan and the front timing cover. We've taken to filling this entire radius with a light coating of RTV in an attempt to minimize these leaks.

Speaking of RTV, among the best of these silicone sealants is the Permatex Ultra Black and Ultra Gray. Most places you look for recommendations will offer these room temperature vulcanizing (RTV) sealants as among the best performing materials.

We also like to use oil pan studs in place of bolts both to facilitate alignment but also to keep the gasket in place while installing the oil pan. Any stud kit will work, but we especially like the ARP studs because they employ a small, rounded end to help the nuts start threading properly.

While we're still lurking about the bottom end, crankcase pressure is the silent enemy of any attempt at a leak-free engine. This pressure helps push oil past all the seals no matter how good a job you do. Our lesson on the effects of crankcase pressure was a simple mistake when we stupidly inserted the bottom half of a two-piece rear main seal in backward.



3. If you find oil seeping from behind the seal on the front cover, try sealing the outside with a light film of RTV to cover the area between the cover and the oil pan. Sometimes this helps.

4. Don't forget to install this major oil channel plug into the deck surface on the rear portion of the driver side. If this plug is omitted, it will cause a massive oil leak when pressure lubing the engine. The driver side cylinder head must be removed to access this plug.

As soon as we started the engine on the dyno, it literally puked puddles of oil on Westech's dyno floor. It was embarrassing. Instead of yanking the oil pan to effect the repair, dyno guru Steve Brule' offered to install a vacuum pump on the engine to get us through the test session. The vacuum pump created roughly 8 inches of mercury (Hg) in the crankcase and immediately eliminated the leak. It was an amazing illustration of how crankcase pressure contributes to leaks.

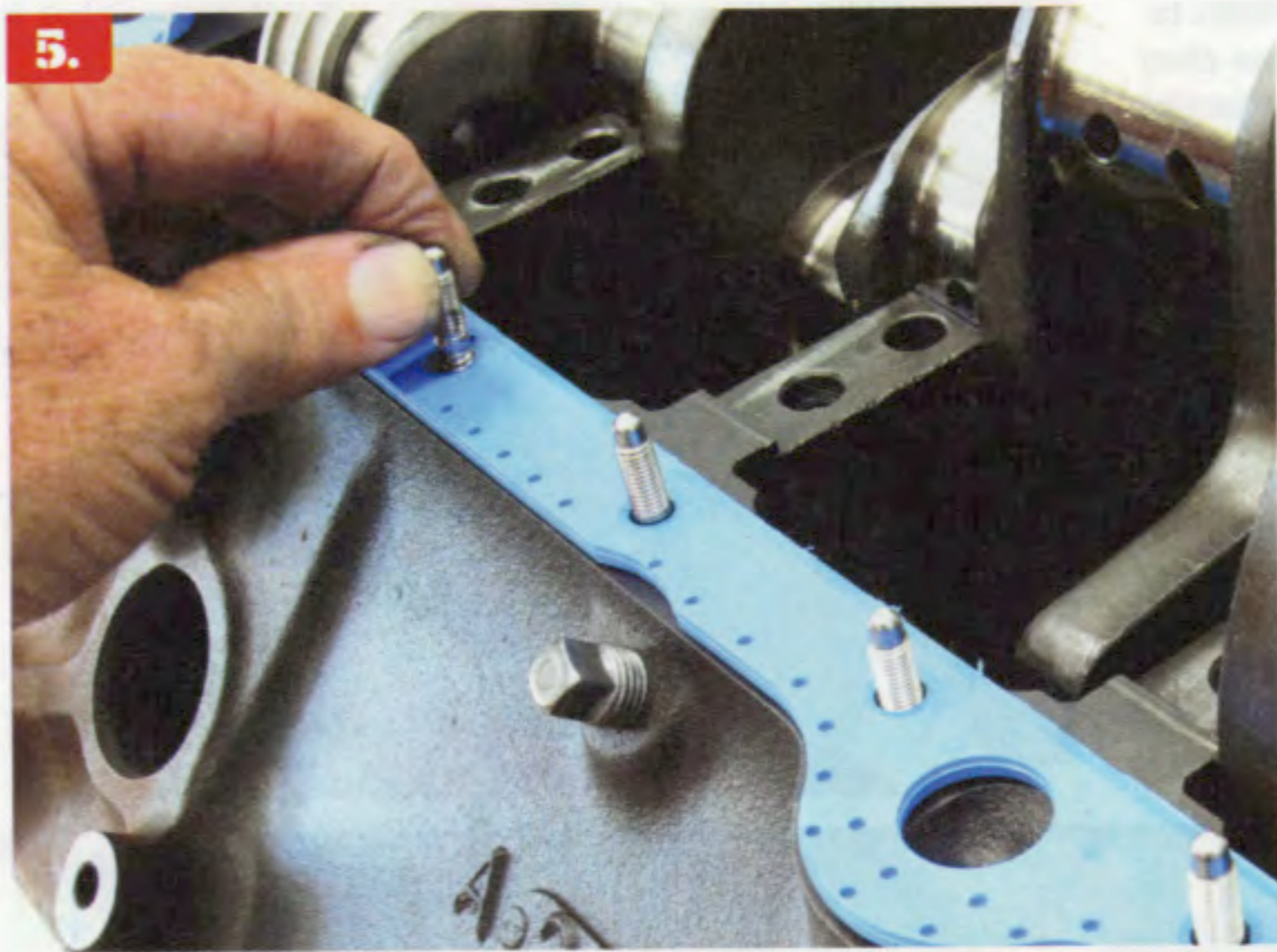
The point of that little escapade was to illustrate how an adjustable, high-volume PCV valve can pull a slight amount of vacuum in the crankcase sufficient enough to minimize oil leaks by minimizing crankcase pressure. A further illustration of that was one of our small-blocks that would push the dipstick out of its tube every time the engine was pushed hard—further evidence that pressure was building inside the engine.

Simple vent tubes in the valve covers often do not do a sufficient job of venting crankcase pressure. The best solution is a PCV valve like the two-stage, adjustable billet aluminum valve from M/E Wagner. This simple little device has proven itself to minimize leaks in any engine by reducing crankcase pressure during part-throttle operation. In our opinion, every street engine should have one of these valves along with a small vapor separator tank because this valve can pull oil right out of the engine even with a separator in the valve cover.

If you forget to install the oil plug in the deck surface of most small-block Chevys, you will discover it immediately when you pressure-lube the engine because it will squirt oil right into your face. If you forget this plug, the driver side cylinder head will need to be removed before you can access this plug. This is why it's best to install the plug before the heads are torqued in place.

Engines with ton of miles on them often wear a tiny groove in the harmonic balancer sleeve from the front seal. Pioneer (among others) makes a sleeve that slips over the harmonic balancer snout for a simple and inexpensive fix that should alleviate this minor leak path.

When installing intake manifold gaskets, it's worth mentioning that RTV will dissolve in the presence of gasoline. A better intake gasket cement for the intake gaskets is to use a sealant called Gasegacinch, which is impervious to gasoline. This also brings up a slightly less common ailment with small-block Chevys that we've seen happen several times.



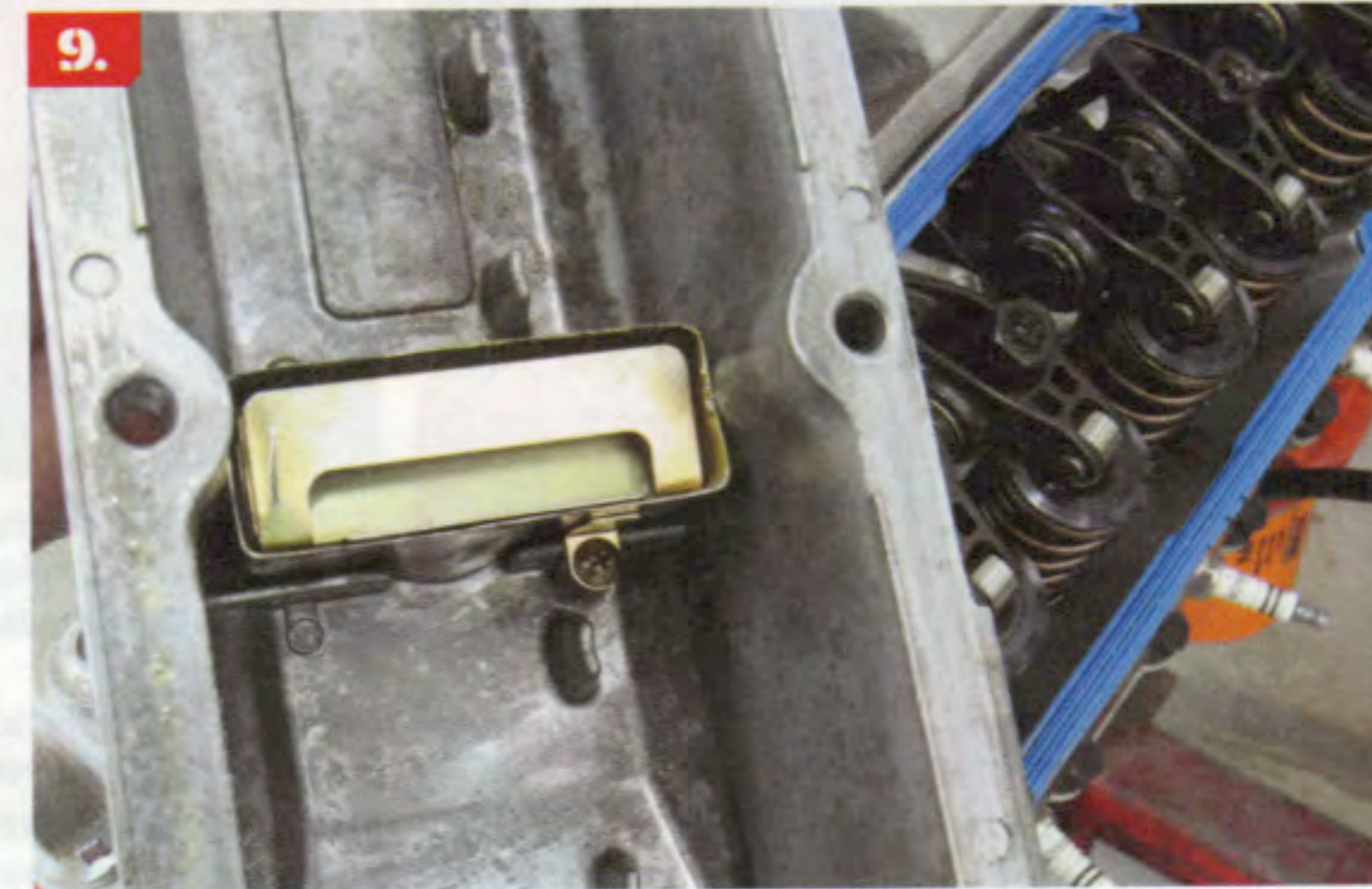
5. The original small-block four-piece pan gasket set is a time-consuming hassle to install as there are four connections that are potential leak paths. Fel-Pro makes a silicone one-piece pan gasket that offers a much greater chance for a leak-free oil pan connection. There are several variations on this gasket based on the location of the dipstick and one- or two-piece rear main seal options so be sure to order the correct gasket.



6. Most two-piece rear main seal blocks feature this tapped, 3/8-inch bolt boss in the front near the fuel pump. This hole is drilled into the channel for the fuel pump pushrod. If this short, 3/8-inch bolt is omitted, it becomes an obvious leak channel. Make sure the bolt is short enough to not contact the fuel pump pushrod.



7-8. One of the best ways to minimize leaks is to reduce the inevitable pressure in the crankcase by using an M/E Wagner billet, adjustable, dual-circuit PCV valve. This valve will reduce crankcase pressure, which will immediately reduce the potential for oil leaks. This valve is best combined with a vapor separator canister because the valve flows so well that it can more easily pull oil out of the engine if the valve cover is not properly baffled.



9. When using a PCV valve, it's best to include a vapor separator baffle in the valve cover to prevent pulling liquid oil into the valve. Even tall valve covers need these baffles.

We've also been victimized by an oil leak created when the intake manifold is not parallel with the intake port face of the heads. This can cause the bottom of the intake gasket to not seal properly because of an insufficient clamp load on the gasket. A simple way to test this is to use four lengths of wax string at the corners of the intake ports and bolt on the intake without the gaskets. The string will compress differently top to bottom and reveal if the intake and heads are not parallel.

This string can be purchased from an online dental supply company called Net32, or Hughes Engines offers a small string kit. This is not a common issue but will lead to high oil usage since the intake manifold vacuum can easily pull oil right out of the lifter valley. We had a small-block pull oil only from one side of the intake but it was enough to burn a substantial amount of oil in a short time.

Using a quality RTV along the front and rear china walls underneath the intake manifold is another time-honored trick. The china walls are so-called because the curved shape of the vertical walls looks like the Great Wall of China. Don't use those flimsy rubber or cork gaskets supplied with some gasket kits as they often slip out when installing the intake. A solid ¼-inch bead of RTV along those surfaces will easily do the trick.

Another area of minor leakage can be found around the four center intake manifold boltholes. These intake bolts exit into the lifter valley and if the intake bolt threads are not coated with a thread sealer, oil will travel up the threads and exit onto the intake manifold. Again, this is primarily caused by internal crankcase pressure so if that billet Wagner PCV valve is used, this probably won't occur. However, it's still a good idea to treat the threads to mitigate the problem.

Most stock small-block valve covers and many aftermarket versions were stamped from thin sheetmetal and would often deflect or bend. Load spreaders were often used to place more load across a wider area, which will improve the seal, but the best solution might be a stronger, cast-aluminum valve cover. Fel-Pro offers a nice set of thicker cork gaskets with a thin sheetmetal shim in the middle that adds strength to the gasket. The best gaskets we've seen are the blue silicone versions from Fel-Pro that include load limiters that prevent over-tightening the gasket. These gaskets are more expensive but do get the job done.

Implementing any number of these little cures will likely clean up the mess on your garage floor and keep your small-block cleaner and happier. If nothing else, it will amount to more oil remaining in your engine and less kitty litter on the floor of your shop. **ACP**



10. If your engine is using oil but not leaking, it might be pulling oil from the bottom of the intake gasket because the intake gasket sealing surface is not parallel with the cylinder head. This test uses 0.100-inch-diameter wax string placed on all four corners of the intake ports as shown without gaskets. Bolt the intake on and then remove and look at how much the string is squeezed. If the string is wider at the top than the bottom, the two surfaces may not be parallel. Repairing this requires machining the intake manifold to produce parallel planes.

11. There are multiple small-block valve cover gaskets on the market. Among the ones that seem to work the best are Fel-Pro's flat strap-reinforced cork gaskets and the blue silicone versions. The cork versions are more affordable but will raise the height of the valve cover, which might be a problem with some applications.

12. A line of RTV roughly ¼ inch in diameter is usually sufficient to seal between the china wall's front and rear and the intake manifold. Placing a small dab of RTV under the little tabs at the bottom corner of each intake gasket will help seal the corners.

DESCRIPTION	PN	SOURCE
Fel-Pro brown rear main, 2 piece, 350 ci	2912	Summit Racing
Fel-Pro brown rear main, 400 ci, 2 piece	2909	Summit Racing
Fel-Pro silicone, rear main, 2 piece, blue, 350 c	I2900	Summit Racing
Fel-Pro rubber rear main seal, 2 piece	BS11829-1	Summit Racing
Fel-Pro, silicone rear main seal, gray, 2 piece	BS40013	Summit Racing
Fel-Pro one-piece oil pan gasket, 1975-1979	1880	Summit Racing
Fel-Pro one-piece oil pan gasket, 1957-1974	1885	Summit Racing
Fel-Pro one-piece oil pan gasket, 1986-1997	1886	Summit Racing
Fel-Pro steel cork valve cover gasket	1604	Summit Racing
Pioneer harmonic balancer sleeve	HB4121	Summit Racing
Permatex Ultra Gray, 3 oz	82180	Summit Racing
Permatex Ultra Black, 3 oz	82194	Summit Racing
Edelbrock Gasgacinch	9300	Summit Racing
Permatex Thread Sealer	59235	Summit Racing
ARP oil pan stud kit, hex head, black oxide	234-190	Summit Racing
ARP valve cover stud kit, black, 1.50" length	200-7603	Summit Racing
Intake manifold wax string kit	HUG Waxwire	Hughes Engines
10-gauge blue dental was string	85642	Net32.com
M/E Wagner billet, dual flow PCV valve	DF-17	mewagner.com

► SOURCES

AUTOMOTIVE RACING PRODUCTS (ARP)

(800) 826-3045

arp-bolts.com

FEDERAL-MOGUL (Fel-Pro)

(248) 354-7700

tenneco.com

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