TECH ARTICLES

The Last Small-Block: Chevy's Gen. II LT1/LT4 1992-97

Posted by Jim Smart on September 2, 2020 at 5:11 pm

(Image/Jim Smart)

Chevrolet's LT1 engine family evokes all kinds of emotions among Bow-Tie guys.

Archives

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Those in the know remember the original 350 cubic-inch LT1 introduced in 1970 was a real powerhouse with a hot mechanical cam and 370 horsepower on tap from the factory.

It was the last really hot Chevy small-block ever done, with the exception being the high-revving Trans Am-inspired 302 c.i.d. Z28 in 1969. The 350 LT1 rocked. In the years to follow, the LT1 lost adrenaline to tough federal emission standards and higher auto insurance rates. By the mid-1970s, the honeymoon was over.

As the 1980s unfolded, performance became more in style, with Chevrolet leading the pack in that age-old battle with Ford. Those fuel-injected 5.0L Mustangs were a force to be reckoned with and Chevrolet was paying close attention. Chevrolet brought us Cross-Fire injection in 1982, which didn't impress anyone. In the mid-1980s, GM brought us Tuned Port Injection (TPI), which was tunable and certainly a smashing success. TPI endured and remained an industry standard for years.

The redesigned Gen. II LT1 Chevrolet small-block (L98) introduced in the 1992 Corvette was an updated version of the time-proven small-block first introduced in 1955 with its share of interesting refinements—some quite controversial.

The cam-driven water pump with reverse-flow cooling and OptiSpark ignition system were revolutionary. However, OptiSpark has always been problematic. It has also been refined and improved by both GM and the aftermarket. MSD, as one example, offers a terrific OptiSpark replacement distributor as does Accel.

You can even retrofit the LT1/LT4 with a cool LS coil-on-plug ignition system and eliminate OptiSpark entirely.

The **Lingenfelter Performance Engineering coil-on-plug conversion** solves the OptiSpark ignition issues. The LT1 coil-on-plug converters with adjustable retard and intelligent rev limiter still use the optical module in the OptiSpark distributor, but without high-voltage passing through it.

Inside the LTCC package, you have the LTCC module and the harness with eight leads, each with a Weatherpack connector and ground wire, a pigtail connector, and four non-harnessed wires. There are plenty of OptiSpark ignition choices to meet your ignition needs.

The LT1 engine in displacements of 265 and 350 cubic inches was employed in a number of General Motors vehicles including the 1992-'96 Corvette, 1993-'97 Camaro and Firebird, 1994-'96 Chevy Caprice and Impala, Buick Roadmaster, and the beasty Cadillac Fleetwood luxury rides.

What made the LT1 series so successful was greater amounts of power by yielding a broader torque curve enabling full-sized luxury cars to accelerate aggressively to speed onto the freeway. In performance vehicles like the Impala SS, Camaro, and Firebird, it roared out of traffic lights in an inspiring fashion. It rocked. What's more, there was so much you could do with it in terms of performance.

Let's Get to It

We're working with a 1996 vintage LT1 block, identifiable

by its “327” visible in the block and a casting number of #10125327 for the 5.7L V8 with a 4.000-inch bore.

This block casting was used from 1992-97. There’s only one other LT1 block casting numbered #10168588 for the smaller bore (3.736-inches) L99 4.3L V8 (265 c.i.d.), which was available in the Caprice as the base V8. What we’re about to do here applies to both the 350 and the 265.

What makes the 1992-97 LT1 block different from the traditional Chevy small-block is what it has—and what it doesn’t have. It doesn’t have an accommodation for a distributor like most Chevy small blocks. Instead, it has an oil pump drive stuffed in the block in back secured by a single bolt. The LT1 block really is an entirely different block and needs to be treated as such. Some items are interchangeable—some are not. Intake manifolds, as one example, are not.

L&R Engines of Los Angeles, CA provided us with a standard bore LT1 5.7L block bored and honed .030-inch oversize (4.030”). The block has been professionally cleaned, prepped and machined for this build effort. This block has been line-honed, bored and honed, and the decks cut to give us a clean, crisp, ready to assemble short-block.

When Chevrolet introduced the 300-hp LT1 (Gen. II) fuel-injected small-block in 1992, it was a more-advanced 350 c.i.d. Chevrolet V-8 small-block, which was a cut above the Tuned Port Injection small-block first introduced in 1984.

TPI set a new benchmark for performance when it debuted in the all-new 1984 Corvette and the white-hot 1985 IROC-Z Camaro. It offered incredible performance coupled with something unheard of with high-performance V8 engines of the era—fuel economy. Port fuel injection coupled with aggressive roller tappet technology made the TPI a quantum leap in performance. No one did it better than Chevrolet.

The new Chevy Gen. II LT1 took TPI to the next level with features that made it a vastly improved small block. The objective was reduced emissions and greater amounts of power. GM did away with the belt-driven water pump and rear HEI distributor—replaced with a camshaft-driven, reverse-flow water pump, and OptiSpark ignition.

OptiSpark was a pancake-style, light-triggered electronic distributor located beneath the cam-driven water pump. There were two types of OptiSpark ignition systems. There was the unvented (1992-'94) and vented (1995-'97). You will want the vented OptiSpark.

A reverse-flow cooling system was conceived to compensate for the much higher 10.5:1 compression ratio long with leaner fuel mixtures to clean up emissions. Reverse-flow became the standard all across the auto industry.

Chevrolet's selling point in technology would also be the Gen. II's undoing. OptiSpark was plagued with reliability problems that troubled Corvettes, Camaros, and other GM models in the 1990s. Oil leaks around the water pump drive not only spotted driveways, but Chevrolet's great reputation for reliability and performance. Between

GM's efforts, and the aftermarket's, these problems aren't as bad as they used to be. However, they have to be a priority for your LT1 build. Your job is to build a trouble-free LT1/LT4.

Despite the LT1's engineering shortcomings up front, it was a terrific factory small block sporting a nodular iron crank, powdered metal "cracked" connecting rods, and hypereutectic pistons. In 1992, the LT1 yielded 300 hp. By the end of production in 1997, it was making 330 factory ponies in the powerful LT4.

GM made two types of Gen II LT1 blocks in the 1990s—two-bolt main and four-bolt main. Four-bolt main versions were factory installed in Corvettes mostly. However—expect to see the four-bolt main LT block in nearly anything built in the 1990s. Because they both have the same casting number of "327" they are impossible to confirm without removing the oil pan.

Although most 1992-97 LT1 engines had aluminum heads, it is important to remember there are LT1s with iron heads found in full-size GM sedans of the era. The Caprices had similar-looking 265 c.i.d. small-blocks (L99) that resemble the LT1. These engines are easily identified by their smaller 3.740-inch bores and iron heads. Don't accidentally pick one of these up for your LT1 build project.

When we decided to build a Gen. II LT1 383 stroker, we understood it was a significant turning point in the small-block Chevy's 37-year history. It would also be the small-block Chevrolet's curtain call—the end of a very successful design run that would end on a mass scale at the 42-year

mark.

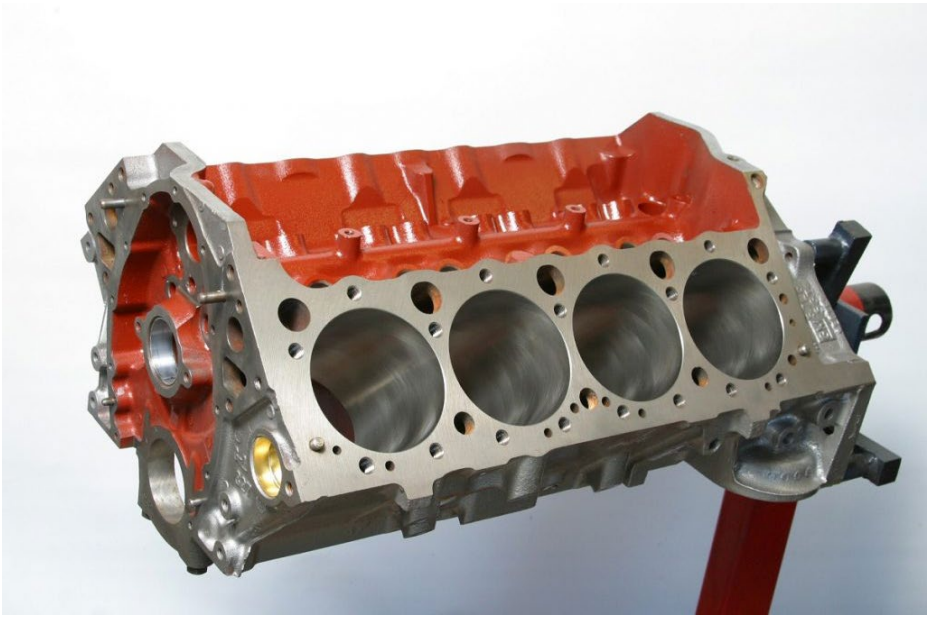
Truth is, Chevrolet never really stopped building small blocks because they're still available as crate engines from Chevrolet Performance. And if you're really into numbers, Chevy has built well in excess of 90 million small blocks since 1955. It is easily the most common V8 engine ever produced and distributed around the world.

We're building a solid, reliable LT1 383 c.i.d. stroker to see just how much power we can make from GM's LT1 5.7L engine.

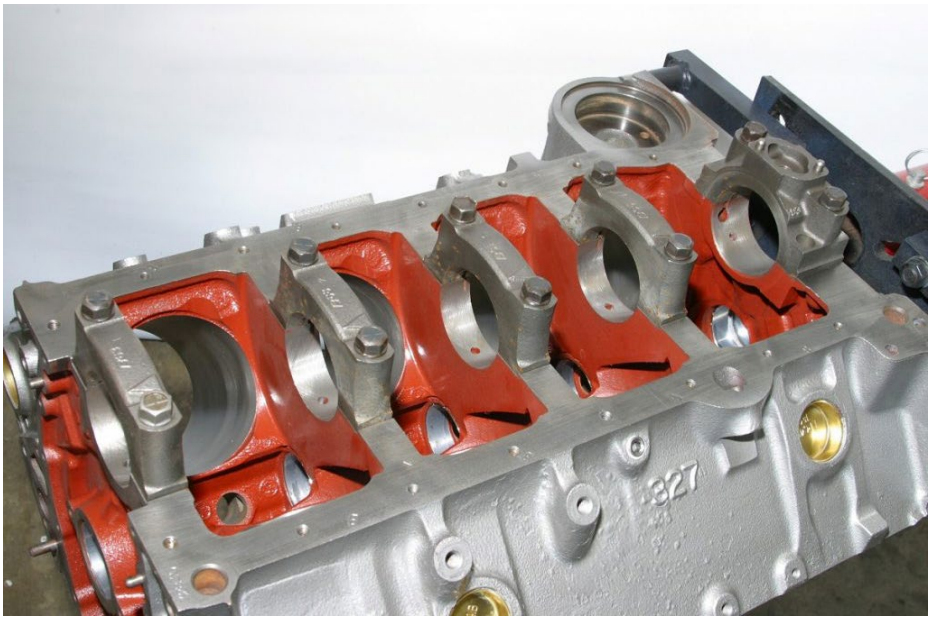
Mark Jeffrey of Trans Am Racing in Gardena, CA volunteered to build our LT1 turned LT4, with the objective being 450 hp, with a broad, stump-pulling torque curve. Mark had **Air Flow Research cylinder heads** in mind for our LT1 build along with an aggressive street cam package that would be good for both the commute and racetrack.

However, the car's owner wanted a stealthy—stock in appearance, using as many genuine GM parts as we could muster on the surface. We copped LT4 heads and induction from Chevrolet Performance, which were available at the time this engine was built in 2005. Thanks to a 383 c.i.d. stroker kit from Coast High Performance, a hot roller cam kit from COMP Cams, and custom port and bowl work from Mark Jeffrey at Trans Am Racing, we were able to take a 300-horse LT1 and make 475 hp. Imagine what you could do with AFR heads— which would push it way over 500 horsepower.

Let's get started.



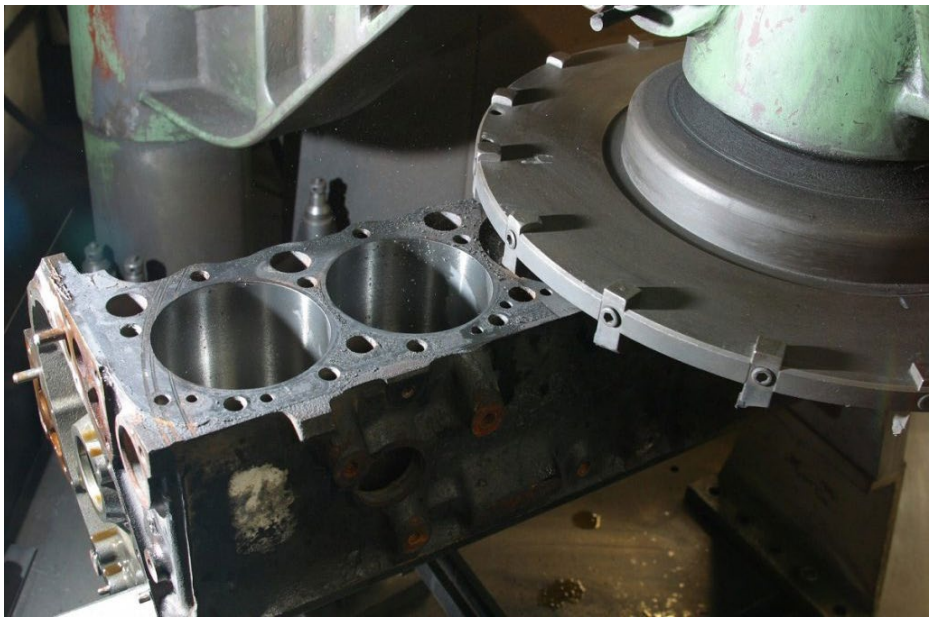
We're working with a 1996 LT1 block with two-bolt mains that has been thoughtfully prepared by L&R Engines of Los Angeles. GE Glyptal, which is a coating intended for electric motor windings, makes a great high-temp casting sealer. It improves return oil flow and seals the iron. (Image/Jim Smart)



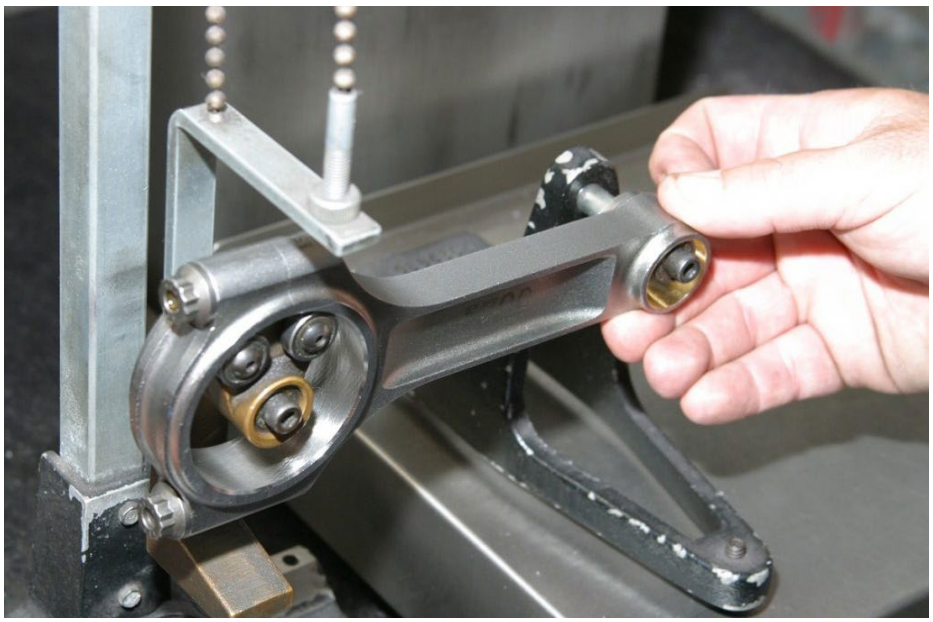
The LT1 block was produced in two- and four-bolt main versions. Four-bolt main versions were installed primarily in Corvettes, but expect to see them anywhere. It is challenging to find standard bore LT1 blocks because they were produced for such a short time from 1992-97. Measure the bores before putting your money down. There were also small-bore GEN II blocks produced for Impalas and Caprices in the 1990s. (Image/Jim Smart)

The line bore is checked and honed for good bearing crush and security. If you're going to convert to four-bolt mains, now is the time to do it. (Image/Jim Smart)

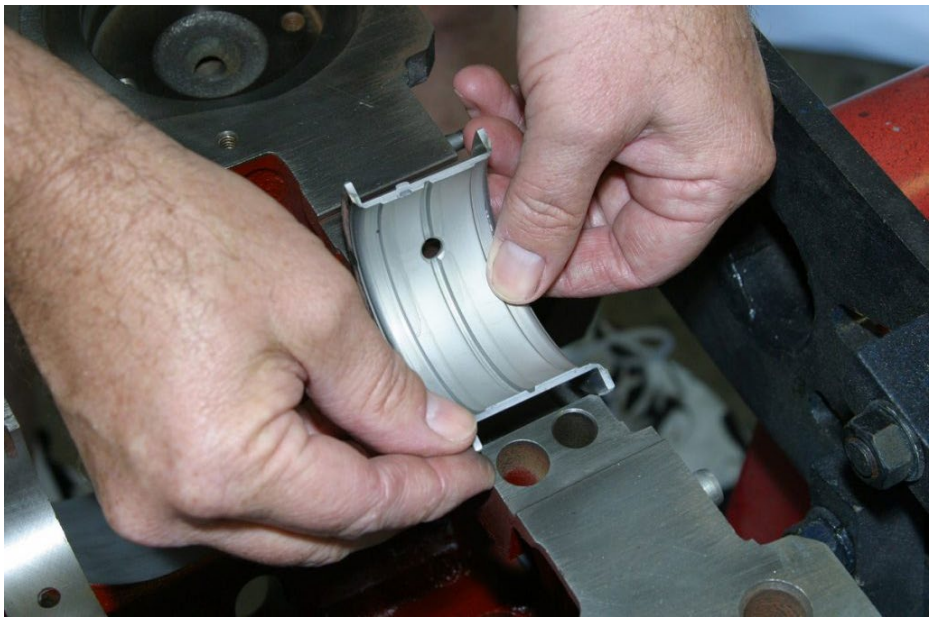
We hit pay dirt because this is a standard bore block at 4.000-inches. L&R Engines bored and honed this block to 4.030-inches. This, coupled with a stroker crank and rods, gets us to 383ci. Blocks must always be honed with a torque plate.



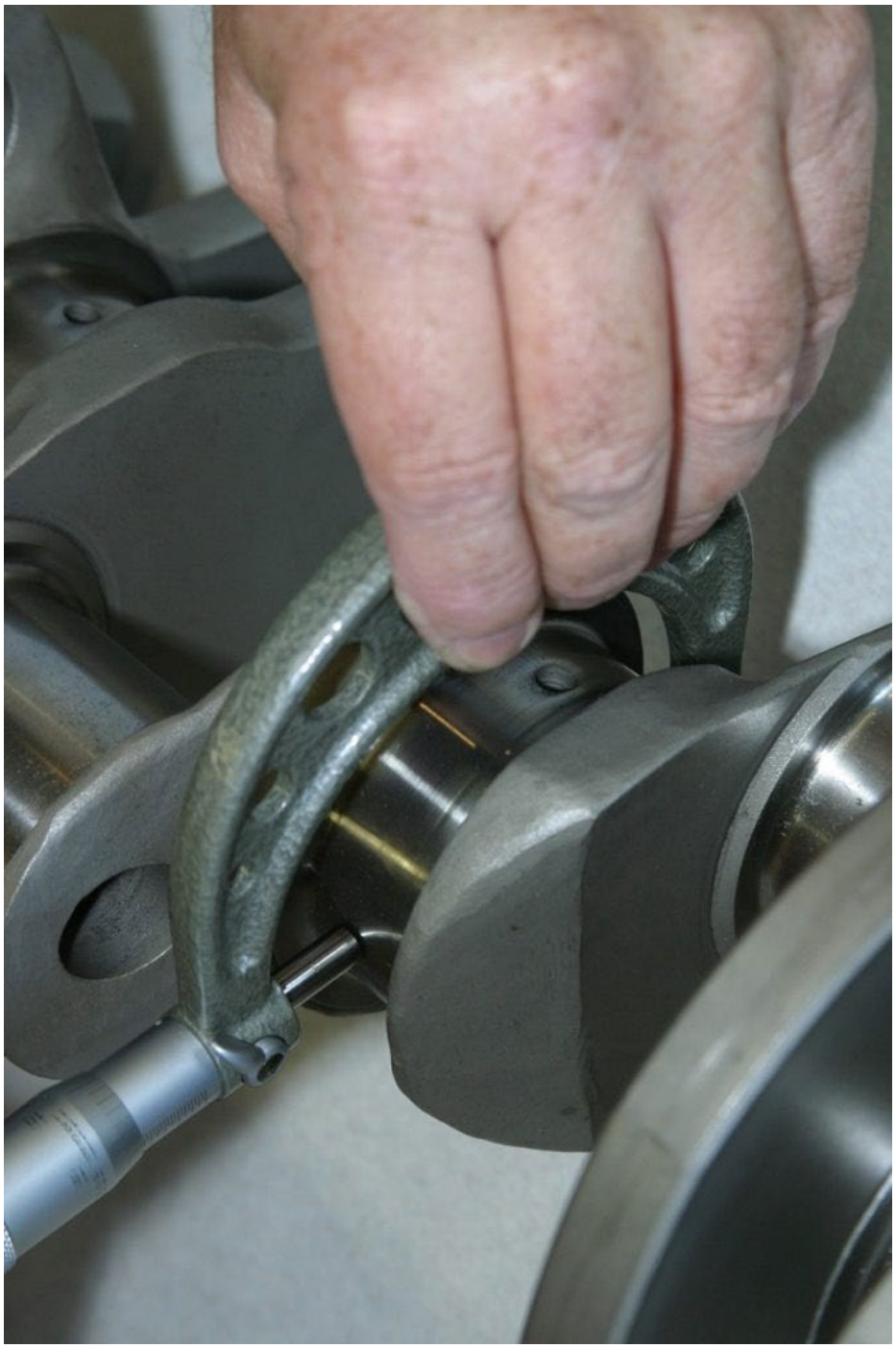
Block decks are shaved .005-.010-inch for a nice uniform head fit. (Image/Jim Smart)



Although our stroker kit was pre-balanced, L&R Engines checked dynamic balance a second time for added assurance. (Image/Jim Smart)

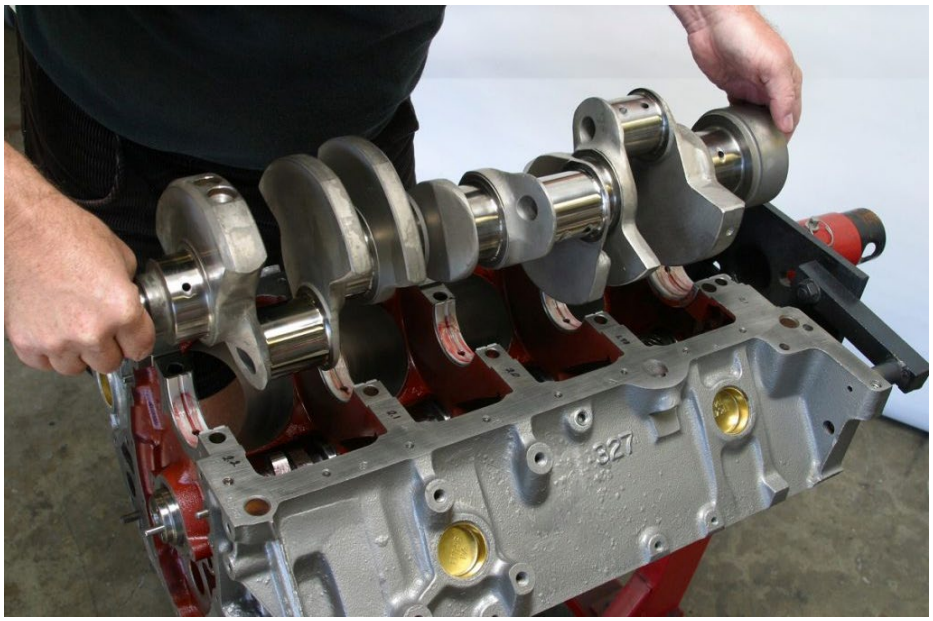


Because we're running a cast steel crank (fancy term for high nodular iron), we've opted for standard bearings. (Image/Jim Smart)



Always double and triple check your components. Crank journals and bearings are miked to confirm bearing clearances. Bearing clearances for street and performance applications is 0.001-inch of clearance for every one-inch of crank journal diameter. (Image/Jim Smart)

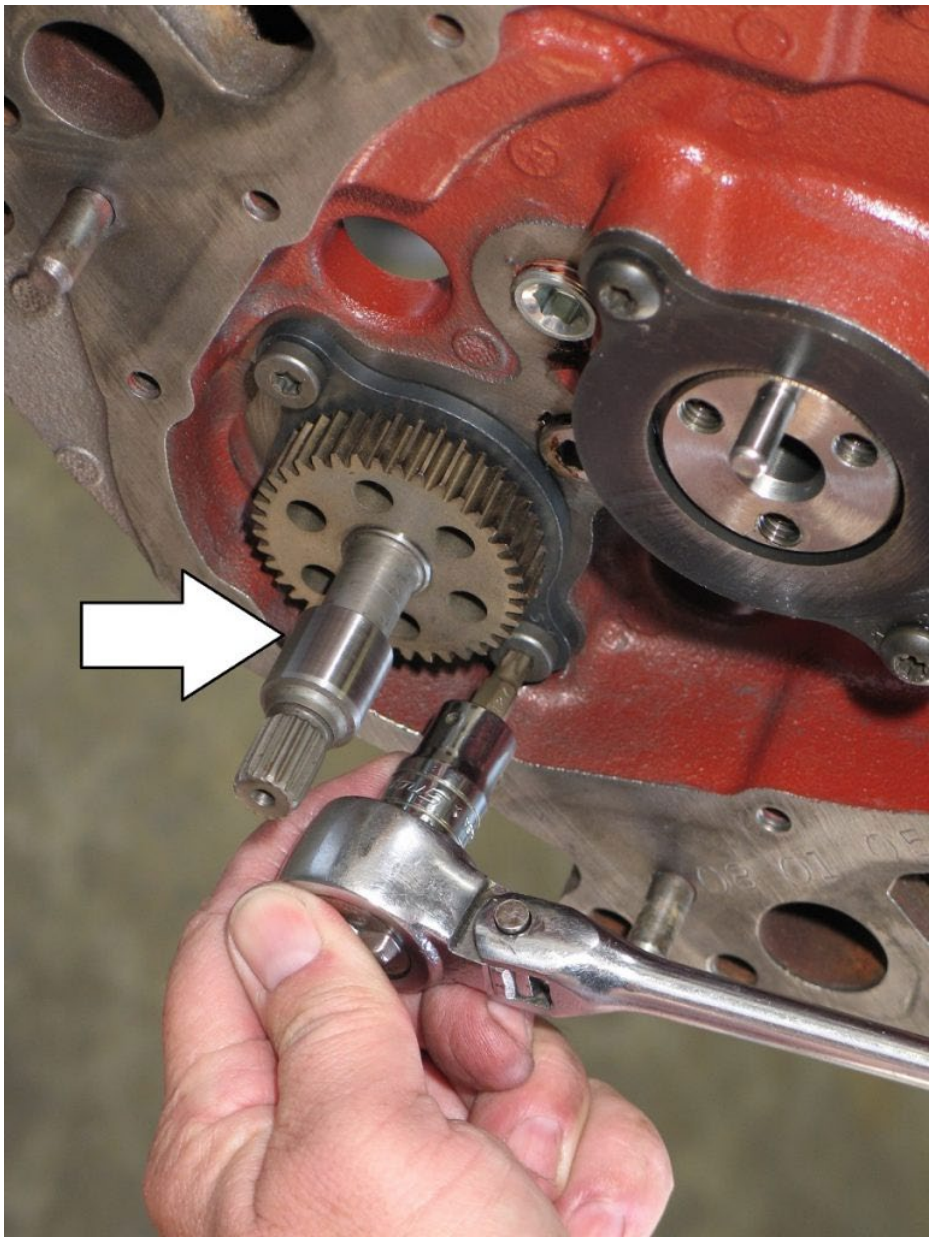
Summit has a wide variety of hot camshaft profiles for you to choose from. We've opted for a Comp Cams custom grind (#LT1 – 3192S / 3192S – HR110.0) roller hydraulic camshaft with Pro Magnum 1.6:1 roller rockers and one-piece pushrods. This gives us a tolerable idle and comes on strong at high rpm. (Image/Jim Smart)



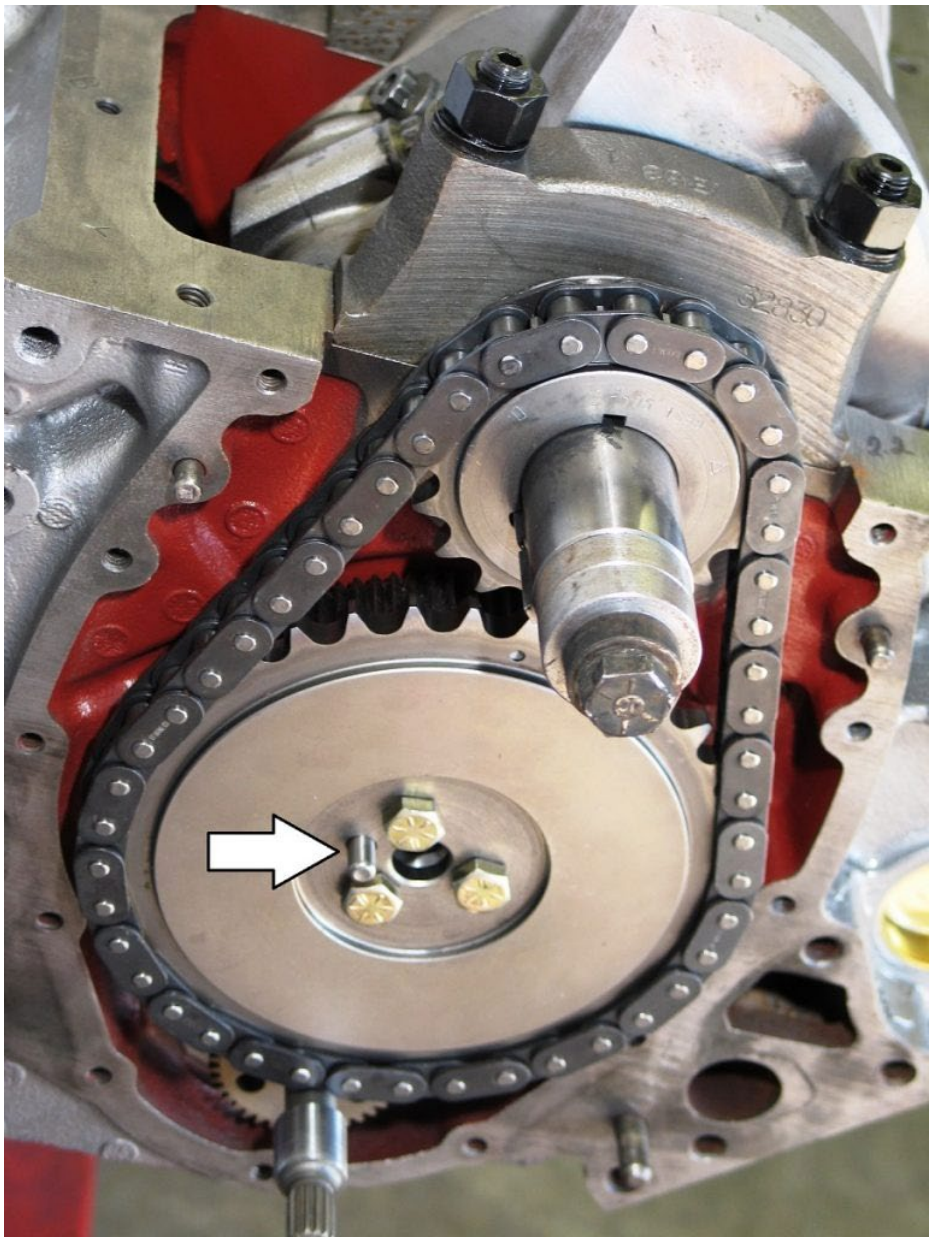
The stroker crank is decked and all crank-to-block clearances are checked. This is especially important with aftermarket stroker kits where you can run into clearance issues. It is so easy to miss piston-to-counterweight clearances and connecting rod-to-cylinder skirts distance. Minimum allowable clearance is .100-inch between any part of the crank and the block. (Image/Jim Smart)

Crankshaft endplay should be .004-.008-inch maximum. (Image/Jim Smart)

Summit stocks a wide variety of billet and adjustable piston ring compressors. If you're a seasoned engine builder and do a lot of jobs, billet ring compressors will make you more productive. We suggest the use of SAE 30-weight engine oil on rings and cylinder walls for good break-in. Engine assembly lube is suggested for bearings, journals, and cam lobes. (Image/Jim Smart)

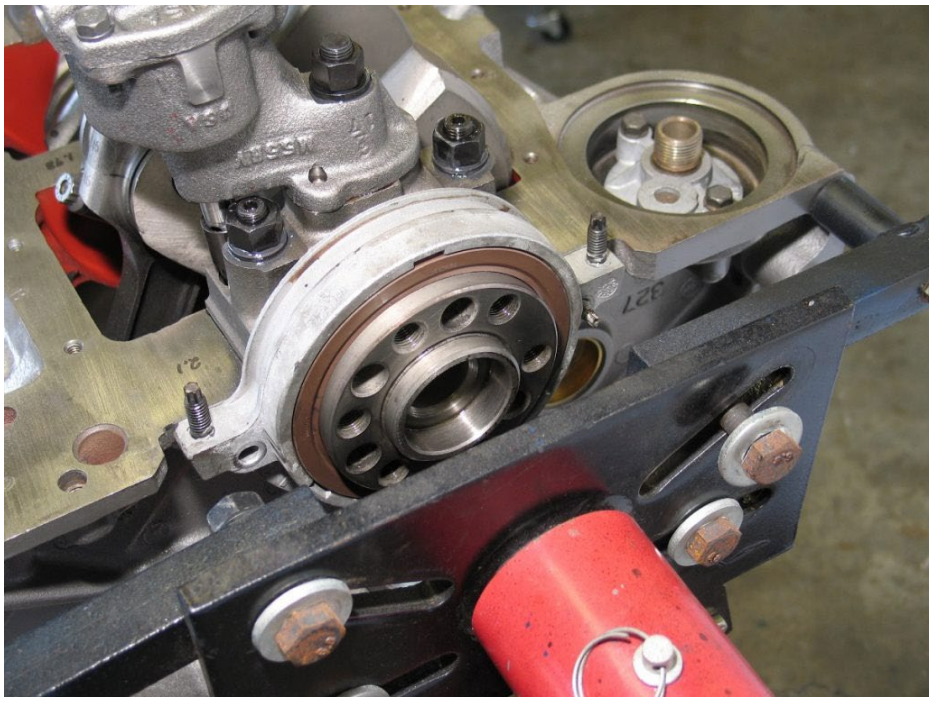


This is what makes the LT1 of the 1990s different than the traditional small block Chevy. This is the OptiSpark/water pump drive, which is bolted to the block as shown. We've found the timing cover oil seals tend to score these pump drives, which causes oil leaks. If you see scoring, replace the cam drive. Some scoring can be polished out. (Image/Jim Smart)

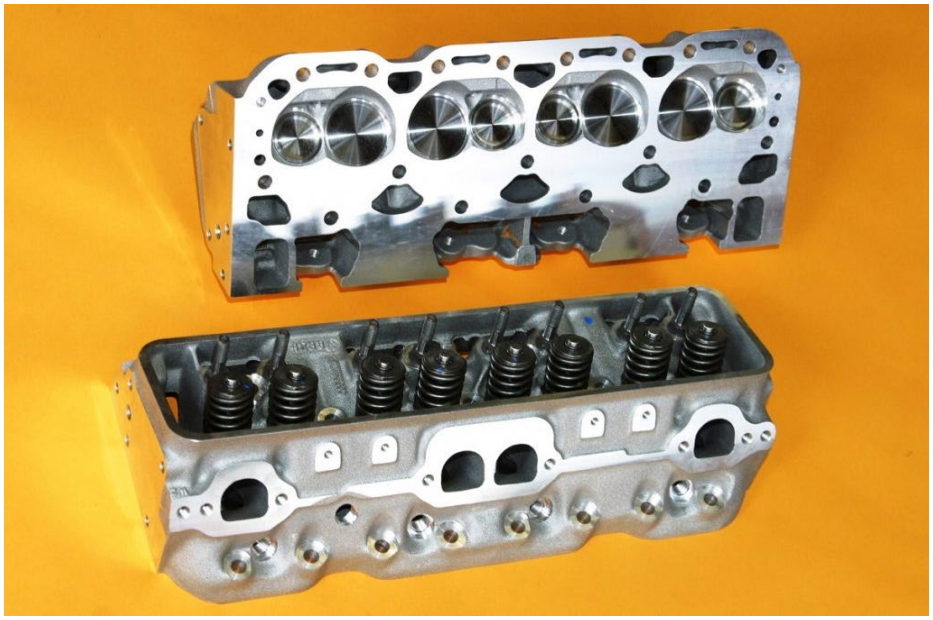


The LT1's complete timing set is installed with the timing marks properly aligned. The LT1/LT4's cam sprocket is different than your typical Chevy timing sprocket. On the back side, it drives the water pump drive gear. This pin (arrow) drives the OptiSpark from the end of the camshaft. (Image/Jim Smart)

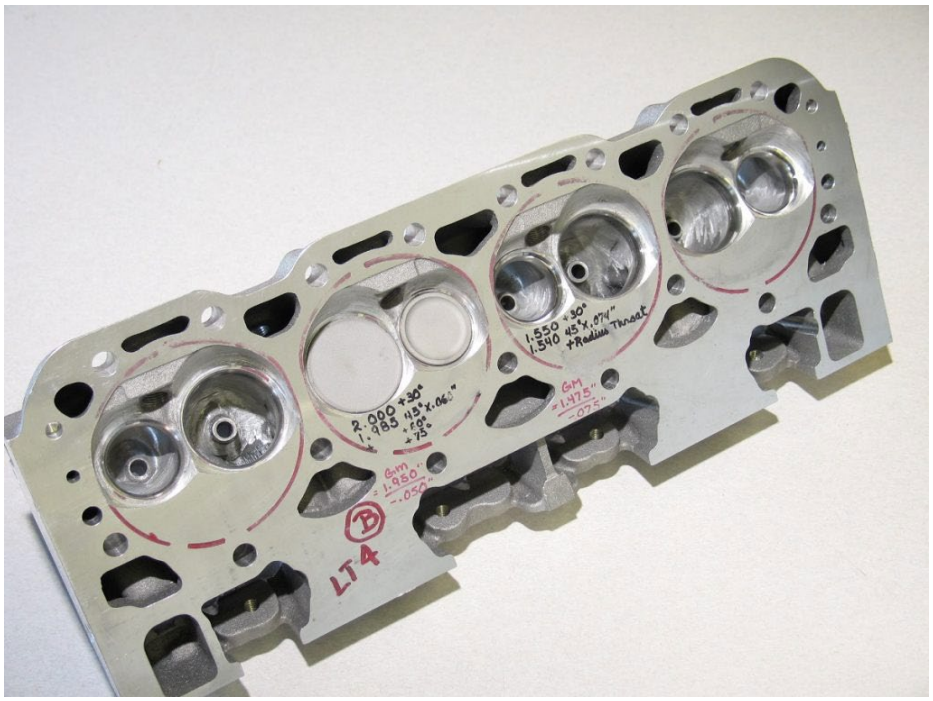
Oil pump clearances are checked as shown. Once this is accomplished, the oil pump cavity is filled with engine assembly lube for a good wet start-up. (Image/Jim Smart)



The one-piece rear main seal is part of a cool bolt-on rear main cover. Never lube the seal lip, which can cause seal failure. Install it dry. (Image/Jim Smart)



When we built this engine years back, we opted for Chevy Performance LT4 cylinder heads and induction, which netted a nice improvement in power. The LT Series cylinder heads can be bolted onto any small block Chevy. (Image/Jim Smart)



Cylinder head wizard Mark Jeffery took our LT4 head castings and massaged the bowls and ports for improved flow. Mark's objective is always a broader torque curve for street and strip use. He likes the idea Saturday night drag racing along with Sunday autocross and canyon cutting, with brute low-end torque for coming out of the turns. (Image/Jim Smart)

Mark's handy work in the ports and chambers shines here. Not only has he opened up the bowls and ports for improved flow, he has removed rough edges that can cause detonation. At the minimum, port work removes the roughness of a cast surface. (Image/Jim Smart)

Viton valve seals like this are an industry standard today because they seal very well, they last, and they do a nice job of controlling oil flow to the valve guides. (Image/Jim Smart)

LT1/LT4 Cylinder Head Types

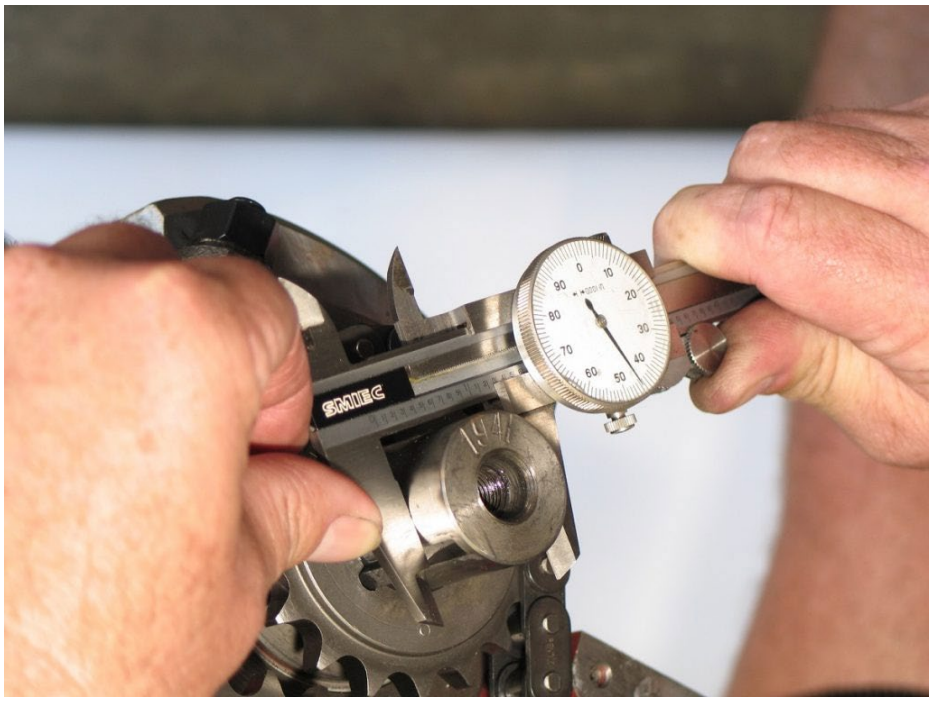
GM produced a number of LT1 cylinder heads during the 1990s. Here's how they stack up. Be careful when shopping for these heads—there were eight different aluminum cylinder head castings produced for the LT1/LT4. LT1/LT4 heads employ rail-style self-aligning rocker arms similar to the LS.

What's more, the valve covers employ bolts through the center of the cover unlike perimeter style bolts on the small block Chevy and even early LS engines. Keep squarely in mind LT1 heads and intake do not interchange with LT4. If you have LT4 heads, you must use the LT4 intake. What makes the LT4 head and induction better is improved port flow and greater compression.

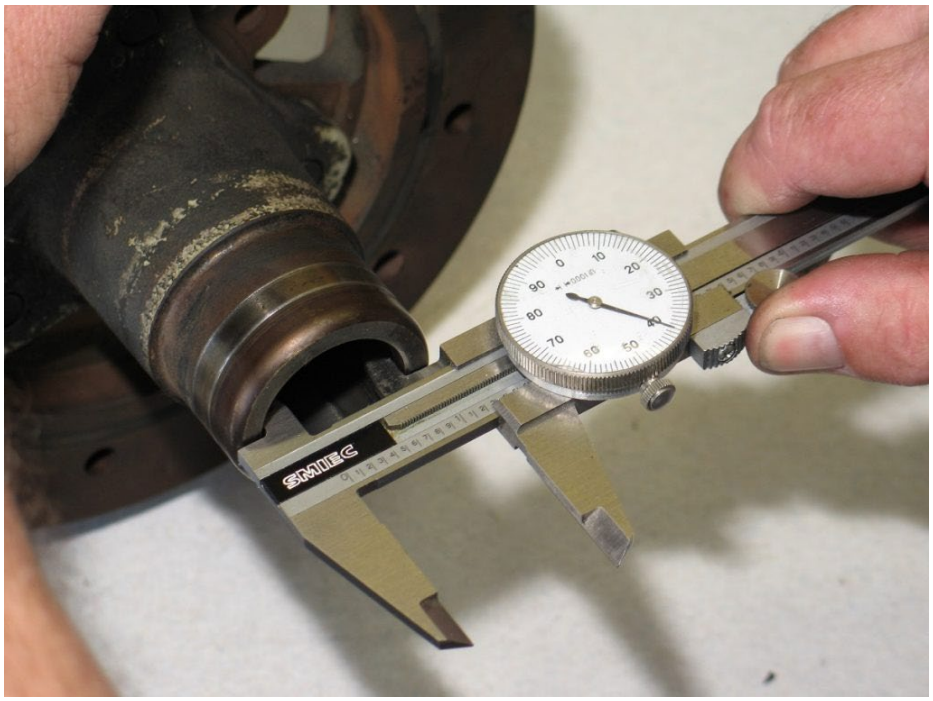
LT1/LT4 Aluminum Head Identification

Type	Specifics	Model Year	Displacement	GM Casting Number
LT1	Intake 175cc Exhaust 68cc Chamber Size 53cc	1992-97	350/5.7L	10128374
LT1	Intake 175cc Exhaust 68cc Chamber Size 53cc	1992-97	350/5.7L	10205245
LT1	Intake 175cc Exhaust 68cc Chamber Size 53cc	1994-96	350/5.7L	10207643
LT1	Intake 175cc Exhaust 68cc Chamber Size 53cc	1996	350/5.7L	12551561
LT4	Intake 195cc	1996-97	350/5.7L	1023990

	Exhaust 68cc Chamber Size 52cc			
LT4	Intake 195cc Exhaust 68cc Chamber Size 52cc	1992-97	350/5.7L	12555690

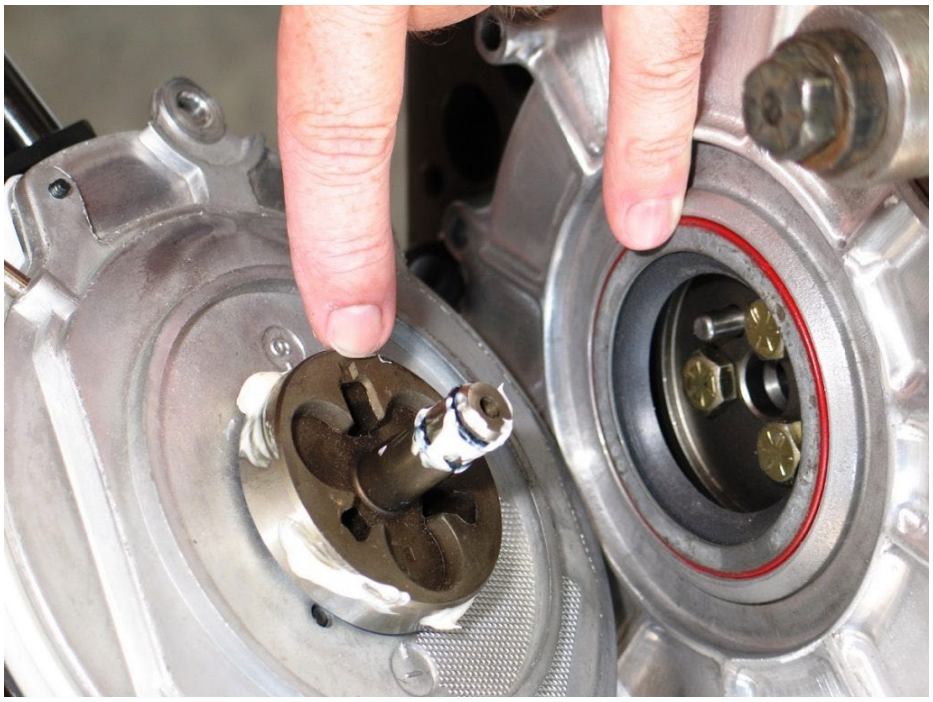


We ran into one snag with the LT1/LT4 engine. Previous small-block Chevys sport a keyway in the crankshaft to keep the harmonic dampener in sync with the rest of the engine. The LT is a taper fit void of a keyway. Our stroker crank has a keyway. Mark had to cut the stock harmonic dampener to fit the crank. The best advice is to purchase the correct harmonic dampener from Summit for this application. (Image/Jim Smart)



The stock LT harmonic dampener will not fit the 383 stroker crank, which is machined for the standard small-block Chevy. It will fit with minor modifications. (Image/Jim Smart)

We've opted for the best ignition components from MSD. Before you here is a stock GM OptiSpark unit. We learned in due course to opt for either an MSD or Accel OptiSpark unit for best results. They last. (Image/Jim Smart)

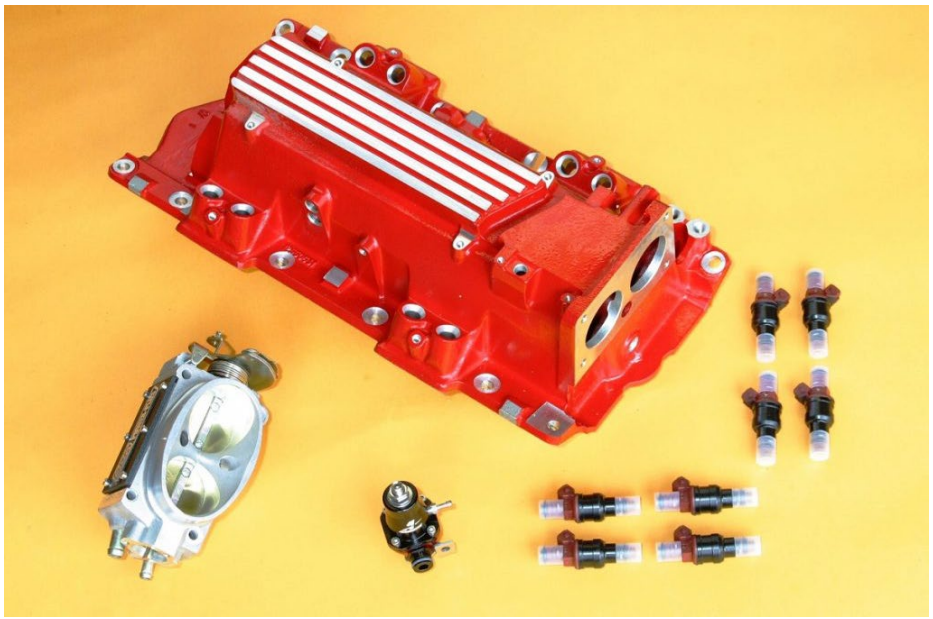


(Image/Jim Smart)

When you install the OptiSpark unit, get the pin lined up properly with the OptiSpark rotor. Generously lube the seal and hub. Firmly seat the OptiSpark as shown. (Image/Jim Smart)

We're opted for a Comp Cams valvetrain system with an aggressive cam profile yielding a smooth idle and a broad torque curve. This is what you want for the street. (Image/Jim Smart)

Mark has done an incredible job on cylinder head prep, opting for Fel-Pro head gaskets. Heads are torqued in proper sequence per the factory specifications. Heads are torqued in one-third torque values for smooth seating. (Image/Jim Smart)



This is the LT4 induction package, which can only be used with LT4 heads. (Image/Jim Smart)

Tags: engine tech, Gen II small block Chevy, LT1

Author: Jim Smart

17 Comments

Pingback: *The Last Small-Block: Chevy's Gen. II LT1/LT4 1992-97*

debrew ernest — October 3, 2020 at 9:17 pm

Information overload but what I always wanted to know these facts. The stupid question I was always afraid to ask my shop teacher:) I love and feed off of this. I will attempt to memorize this article within the next 2 years:(
Thanks

Reply

Sam — October 9, 2020 at 6:43 pm

Holmes if you call this information overload, maybe you should go back to some old issues of many of the now defunct car magazines.
This was well written and informative. Period

Reply

Brian Andersen — November 3, 2020 at 5:09 am

I've a '96 lt4 Corvette that I am collecting parts for a 383 build. If I am aiming for 450-500 hp, will the 4blt. main main block be a good starting point for the build? I keep hearing that the 4blt main block may be prone to cracks along the main web area. Should I start with a 2blt block and machine splayed 4blt mains?

Reply

Frank H English — November 14, 2020 at 8:58 pm

2 bolt blocks are fine at that horsepower level..
Not to mention splayed blocks unfilled are actually weaker in a production block setup as opposed to a bow tie or dart block mho..

Reply

Dale Young — May 26, 2021 at 1:53 pm

It's a lie that 4 bolt mains are weaker than 2 bolt mains. The order of strength for SBCs is splayed billet 4 bolt main caps, straight 4 bolt main caps then 2 bolt main caps. All three setups are stronger with studs than bolts.

Reply

Jose MVB — December 4, 2020 at 8:32 pm

hi guys,, i wanna know if sbc gen 1 engine oil restrictors..will fit Lt1 engine.. i cant find part number for lt1 engine oil restrictors.. thanks...

Reply

Tim Shannon — January 10, 2021 at 7:37 pm

Will the Gen II Lt1 heads work on my 87 359 block

Reply

Jay Torner — January 19, 2021 at 9:31 pm

In the article above you mentioned how the stock harmonic dampner had to be machined to fit, but also mentioned that a new one could be purchased from Summit. Do you have the Summit part number? I purchased a new Eagle stroker crank and I purchased a new harmonic dampner hub. It does not fit the new crank. I called Summit and they could not help. They referred me to call Eagle. I can try to find a machine shop to open the ID of the new hub if Eagle has no response. Rebuilding this LT4 has been a challenge. The previous stroker crank broke at the first rod journal. Thanks for help.

Reply

Pingback: *TPI the L99! The 4.3L "Baby LT1" V8 Gets Torque*

Devinci — April 1, 2021 at 9:52 pm

I have a 97 tranam I was trying to see how can I get about 500hp out the lt1

Reply

Sylvester Bryson — May 13, 2021 at 11:43 am

I have a 96 LT1, I saw a video where a guy machined his block to accommodate a carberator and intake, I was wondering why no one on here mentioned it, is not possible, could it be done????

Reply

Paul Sakalas — July 2, 2021 at 11:29 am

Hey Sylvester, Sure you can convert an 1990s-era LT1 to carb. For starters, there are intake manifolds available that allow you to run a carburetor on an LT1 block. **Check out this one from Chevrolet Performance**, as an example. You'll probably need to ditch the Optispark and go with a more traditional distributor-based ignition setup though. If you'd like some specific help on the conversion, **contact the Summit Racing tech folks**.

Reply

Terry sinks — July 1, 2021 at 7:33 pm

I just bought an Lt1 5.7 engine minus crank and cam and pistons. I want to bring this in at around 400 h.p. From what I can tell it's been bored .30 over it all looked really clean and fairly newly redone. I did find a bent push rod with the side ground down in a check mark type shape, but the person I bought this from doesn't know the history he received it in a trade. All # on heads and intake match your guides and the fuel rail is set up on passenger side. Is this corvette. All the help you can give me would be greatly appreciated. This will be my first build at 59 yrs old.

Reply

Paul Sakalas — July 2, 2021 at 11:26 am

Hey Terry, I found **this forum thread over at CamaroZ28.com** that may be able to help ID your engine.

Reply

Pingback: *Ask Away! with Jeff Smith: Upgrading Fuel Injectors for Better Performance in an LT1-Equipped Chevy Camaro*

Victor Figueroa August 21, 2021 at 7:50 pm

Greetings to all.
It would have helped a lot to those of us who have LT1 / LT4 and want more power, to have left the list and number of parts.
If someone has them, it would be very good for everyone.
Thanks!

Reply

Leave a Reply

Comment

Your Name *

Your Email *

Your Website

Save my name, email, and website in this browser for the next time I comment.

Submit

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