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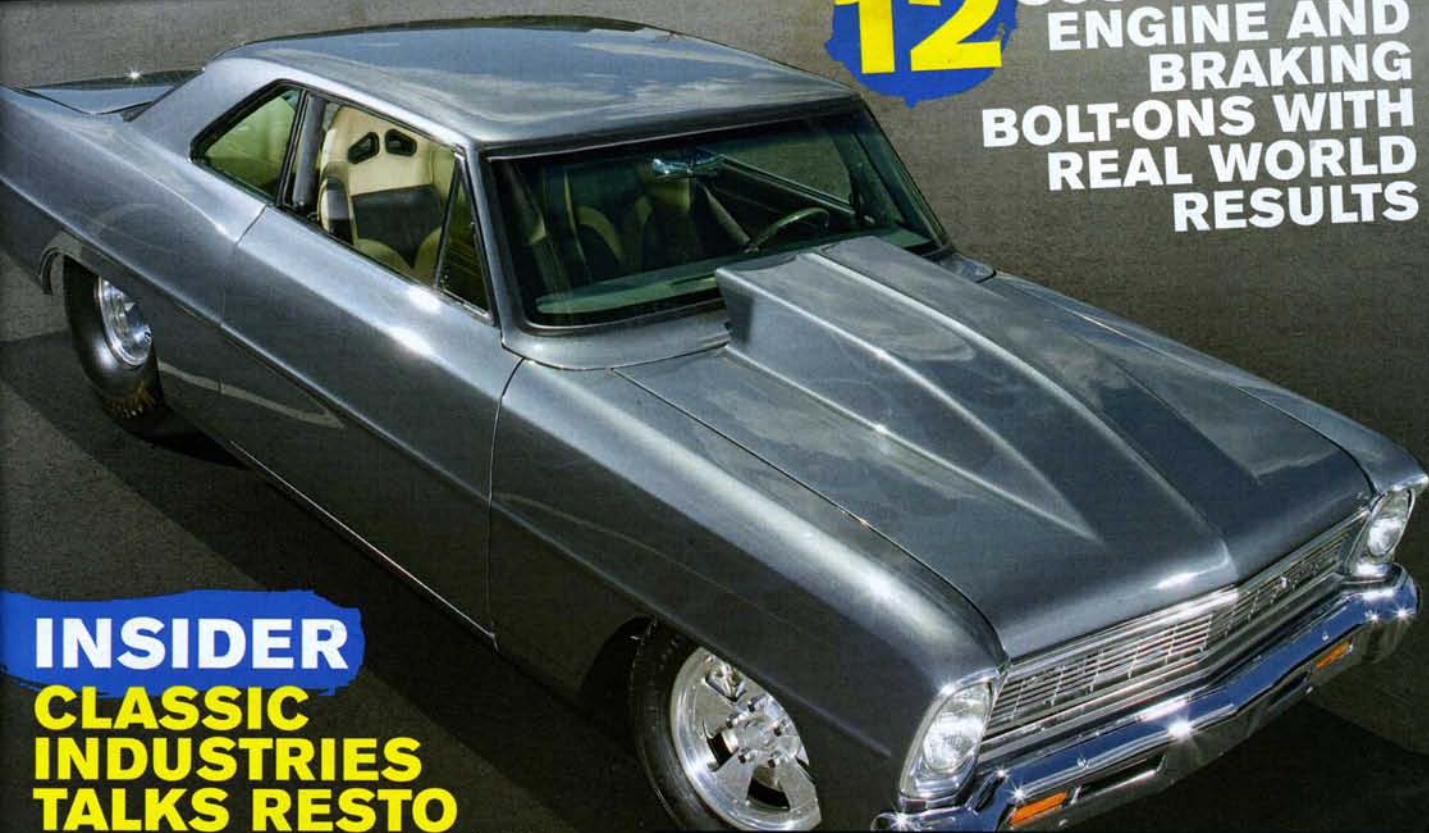
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**BUILD A**  
**500ci LS1**  
**717HP ON MOTOR**  
**923HP ON NITROUS**



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# HOW TO BUILD A 500ci LS1

**Thanks to a Trick Deck Plate and Some Cutting-Edge Machining, Now Anyone Can Build a Gargantuan LS-Series Small-Block** *Text & Photos: Stephen Kim*

Just throw us in the looney bin. In the realm of cubic inches, 500 is a figure reserved for tall-deck Rat motors and Cadillacs. Any notion of ascertaining that level of displacement out of a small-block—or even most big-blocks—is pure crazy talk.

Sanity and common sense aside, we're here to say that it can be done. In fact, it's already been done and here's the kicker: It's been done with a production LS2 block. The motor in question, built by the School of Automotive Machinists in Houston, kicks out 717 hp and 630 lb-ft on pump gas with a dinky 248/254 at

0.050 inch hydraulic cam. The best news is that this isn't some custom one-off build. Anyone can now assemble a 500ci LS-series motor using off-the-shelf parts.

The mastermind who makes it all possible is ERL Performance, best known for its handiwork in the import drag racing scene. In a high-boost world

## QUICK NOTES

### THE BUILD

A 500ci LS motor!

### BOTTOM LINE

717 hp and 630 lb-ft on pump gas

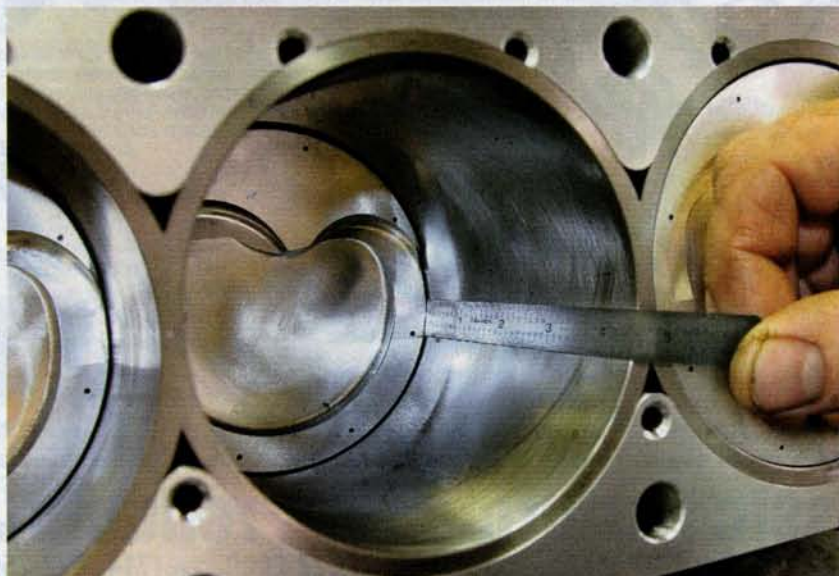
### PRICE (SHORT-BLOCK ONLY)

\$14,900

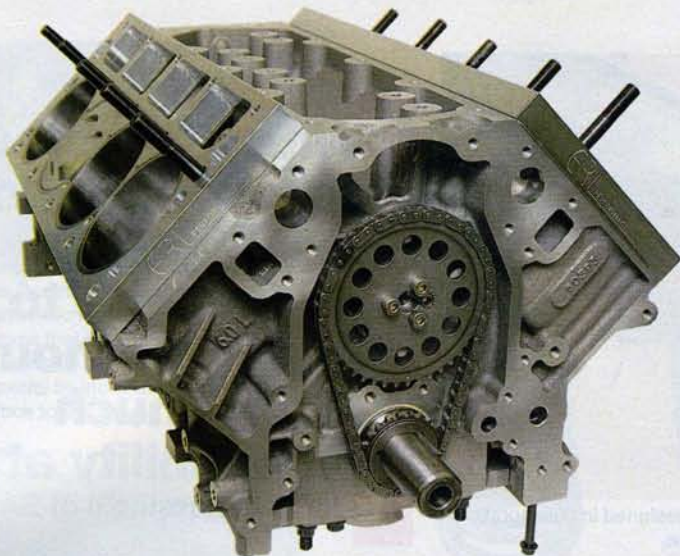
where displacement is at a premium, ERL has perfected the art of making tiny four-cylinder motors a bit less tiny with its innovate deck plates, essentially a slug of billet aluminum sandwiched between the block's deck surface and cylinder head. The added thickness affords a taller deck height and hence a longer stroke and more cubic inches. While it sounds more like an elaborate IED (improvised explosive device) than a viable engine technology, ERL's deck plate system has been proven time and again under the most grueling conditions. We're talking sub-150ci boosted four-bangers pushing close to 1,000 hp on production blocks.

Aware of ERL's credentials, engine builder extraordinaire and LS1 guru Judson Massingill of SAM asked the obvious question while at an industry trade show. "I saw that ERL was doing these amazing things with Imports and suggested that they should apply this same technology to V-8s," he recalls. "At the time, people were starting to really push the limits of the LS1 architecture, and a common problem with stroker motors was scuffing up the piston skirts as a result of pulling them too far out the bottom of the bores. I pointed out that since the cam is positioned so high in the LS2 block and because it has a 4.000-inch bore, they could get some serious displacement out of it with one of their deck plates. I really can't take any of the credit, because all I did was have one conversation with them and they took care of the rest. ERL's finished product is honestly some of the most beautiful machine work I have ever seen."

By increasing the LS2's deck height from 9.240 to 10.200 inches, ERL's Super Deck II block can swallow up a 4.500-inch stroke. Combined with a 4.202-inch bore, the result is 500 delicious cubes. Considering the Gen IV's bore spacing of 4.400 inches, that much bore may seem to push the envelope of strength on paper, but ERL has done its homework. "We use a Darton ductile iron sleeve, which is three times stronger than stock," explains Sean Ragains of ERL. "Also, our deck plate is designed so that when you torque down the head bolts, they apply clamping pressure right at the top of the cylinder



Continued on page 32



The extra meat provided by ERL's deck plates maintains excellent piston stability at BDC, as just 0.100 inch of the skirt protrudes below the cylinder case. ERL starts by removing the factory sleeve and machining the bores and deck surface. Next, new Darton sleeves are pressed into place, and the block is align-bored and -honed. After the deck plate is installed, the bores are plateau-honed.



The 4340 forged-steel crank is a Callies piece that's available through ERL. It retains factory-sized 2.558-inch main and 2.100-inch rod journals and can handle in excess of 1,000 hp.



To reduce cap walk, ERL installs rigid 1/4-inch dowel pins to the main bearing bulkheads. ERL clearances all its blocks prior to shipping.



Depending on a customer's needs, ERL installs bronze lifter bushings for either hydraulic or mechanical cams.



One of the drawbacks of pulling the pistons so far down the bores is that the height of the counterweights must be compromised in order to clear the piston skirts. Furthermore, at 1,741 grams, the bobweight is hardly light. As a result, several slugs of Mallory must be added to achieve balance.

## GET YOUR OWN 500

If the prospect of 500 all-aluminum rippling cubes has already made you bash open your piggy bank, here's the skinny on how to get an ERL setup in your car. The Super Deck II system is sold as a turnkey short-block assembly for \$14,900. If you provide your own LS2 core, ERL will knock \$1,000 off the total. That price includes an ERL block, a Callies crankshaft, full internal balancing, Wiseco pistons, rings, bearings, billet main caps, main studs, bushed lifter bores, intake manifold adapter plates, longer head studs and pushrods, and a cam custom-ground to your application. All you need to add are cylinder heads, an intake manifold, and an oil pan. ERL offers bore sizes from 4.000 to 4.200 inches and will tailor compression to whatever ratio you chose.

# 500ci LS1



Measuring 6.800 inches, the Carrillo steel rods were designed in collaboration with ERL to provide sufficient cam and block clearance.

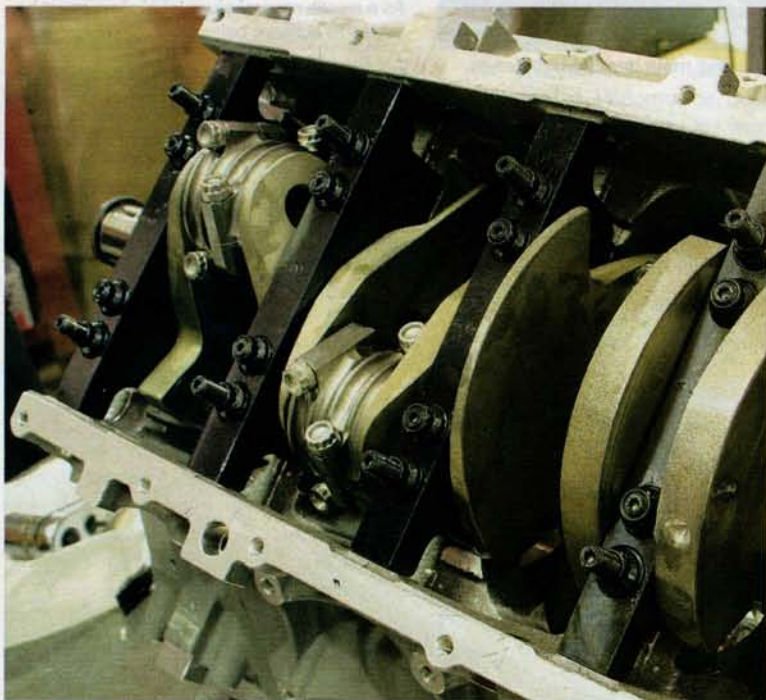
**With a little more cam, this motor would easily make close to 800 hp without losing much streetability at all.**  
-Judson Massingill of SAM



To keep compression to a pump-gas-friendly 10.8:1, the Wiseco pistons have a -28cc reverse dome. They also feature a revised skirt to promote piston stability at BDC in extralong-stroke applications.



Since the goal was to build a streetable motor that represented what many enthusiasts would probably build, SAM installed a conservative Comp 248/254-at-0.050 hydraulic roller cam with 0.647-inch lift. It was ground on a small base circle for additional rod clearance. With slightly more duration, SAM says the combination would easily put out an additional 50-60 hp.



Billet steel main caps are standard on ERL's Super Deck II block. The four inner studs were torqued down to 60 ft-lb and the two outer crossbolts to 19 ft-lb.

## BUILDSHEET

Block	ERL Tall-Deck LS2
Bore	4.202
Stroke	4.500
Displacement	500 ci
Rod length	6.800
Deck height	0
Block height	10.200
Head gasket thickness	0.040
Main bearing clearance	0.0023-0.0025
Rod bearing clearance	0.0022-0.0025
Piston-to-wall clearance	0.005
Piston dome volume	-28 cc
Piston compression height	1.150
Top ring gap	0.025
Second ring gap	0.025
Compression ratio	10.8:1
Camshaft (Comp Cams)	248/254-at-0.050; 0.647/0.647; 114
Installed centerline	114 degrees
Rocker ratio	1.7:1
Valves	2.200/1.615 intake/exhaust
Valvespring diameter	1.539
Valvespring seat pressure	150 lb
Valvespring open pressure	440 lb
Intake manifold	Factory GM LS7
Fuel	93 octane unleaded

Measurements in inches unless otherwise noted



ERL utilizes Darton's Modular Integrated Deck system, which feature Siamesed and nested sleeves that reinforce the upper deck area. The MID system enhances cooling capacity by increasing water flow from the block to the head.



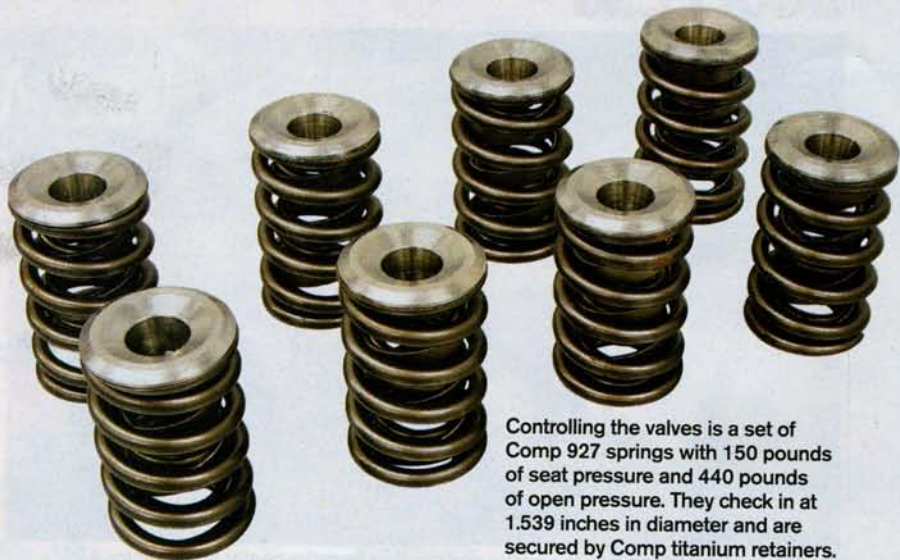
Deck plates require longer head studs. These ARPs were supplied by ERL. For extra strength, ERL enlarges the head bolt holes to 1/2 inch. The Cometic multilayer steel head gaskets are off the shelf.



Feeding those 500 hungry inches is a set of factory LS7 heads. They flowed an impressive 365/215 cfm right out of the box.



With such impressive flow numbers from the factory, porting was kept to a minimum. SAM touched up the chambers, valve seats, and ports, which increased flow to 390/235 cfm at 0.700-inch lift. The chambers measured out at 66 cc.



Controlling the valves is a set of Comp 927 springs with 150 pounds of seat pressure and 440 pounds of open pressure. They check in at 1.539 inches in diameter and are secured by Comp titanium retainers.



Ferrea valves maintain the stock 2.20/1.61-inch diameter. The rest of the valvetrain consists of Jesel 1.7:1 shaft-mount rockers, Comp lifters, a Cloyes timing set, and ERL 9.650-inch pushrods that compensate for the extra deck height.

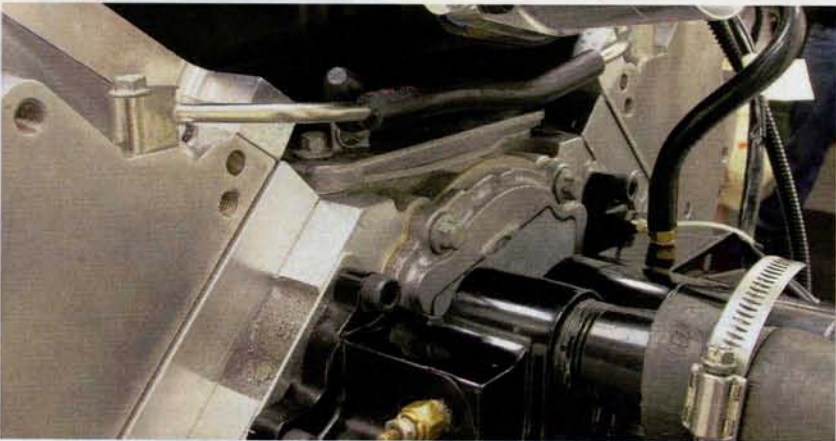


A testament to the simplicity of the build, the 500 utilizes a stock LS7 intake manifold that draws air through an Accufab throttle-body. Managing the pulses on the 55-pound MSD injectors is a stock computer tuned with EFI Live software. A Meziere electric water pump circulates coolant, and the custom 2-inch headers scavenge the cylinders.

# 500ci LS1



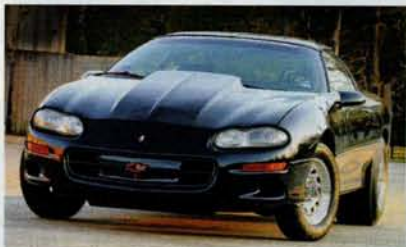
Since the deck plates move the intake ports farther from the center of the motor, ERL supplies 3/4-inch adapter flanges. SAM massaged the openings to mimic the intake ports, which allowed for a smooth transition from the manifold into the cylinder heads.



Since the heads now sit higher on the block, the factory coolant crossover tube must be lengthened. An easy method of doing this is cutting the tube in half, then inserting a coolant hose between each piece and clamping it down.



Even in the tight confines of SAM's '98 Z28, the 500 cleared the shock towers and cowl beautifully, and neither had to be cut or beaten with a hammer. The only custom items in terms of fitment are the headers, which most shops can build for about \$1,500.



SAM track-tests all its engine combos; in a 3,700-pound fourth-gen Camaro backed by a Powerglide and a 9-inch rear, the 500 has run a best of 10.22 at 140 mph on the motor while running out of gear at the 1,000-foot mark. Since then, SAM has swapped in taller gears and a set of 28x10.5 MT ET Drag slicks in place of the ET Streets and will be shooting for high 9s. Considering the SAM 500 served as the first real-world guinea pig for ERL's LS2 design efforts, the fact that everything went together without hiccups is very impressive.

sleeves instead of the deck surface. This directs pressure to a smaller surface area, which results in greater clamping force. The truss design of our deck plate also transmits loads below the deck surface and between the cylinder bores. The result of all this is an extremely strong block with excellent head gasket seal."

So just how much power can it handle? On a 200hp hit of spray, SAM's 500 cranked out 923 hp and 906 lb-ft on the dyno. Furthermore, while ERL suggests backing down to a 4.1250-inch bore on boosted or heavy nitrous applications, its customers are pushing out 1,500 hp in supercharged motors and 1,700 hp with turbos. That's staggering, to say the least, but there's more to ERL's setup than a deck plate, as we'll outline in this story. So enough babbling already and on with the build! **CHP**

## ON MOTOR

RPM	LB-FT	HP
4,300	570	466
4,400	582	488
4,500	600	514
4,600	615	538
4,700	622	557
4,800	626	572
4,900	628	586
5,000	629	599
5,100	<b>630</b>	612
5,200	629	623
5,300	627	633
5,400	625	643
5,500	622	651
5,600	618	659
5,700	614	667
5,800	611	675
5,900	609	684
6,000	608	694
6,100	605	703
6,200	601	709
6,300	595	713
6,400	588	716
6,500	579	<b>717</b>

Avg. Torque 608  
Avg. Power 620

## ON SPRAY

RPM	LB-FT	HP
4,100	597	467
4,200	606	484
4,300	617	506
4,400	626	525
4,500	644	552
4,600	737	646
4,700	866	776
4,800	<b>906</b>	828
4,900	905	845
5,000	904	861
5,100	903	877
5,200	898	889
5,300	889	897
5,400	878	903
5,500	869	910
5,600	857	914
5,700	847	919
5,800	835	922
5,900	821	<b>923</b>
6,000	807	922
6,100	792	920
6,200	777	918
6,300	761	913

Avg. Torque 797  
Avg. Power 797

## GET THE HOOKUP

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