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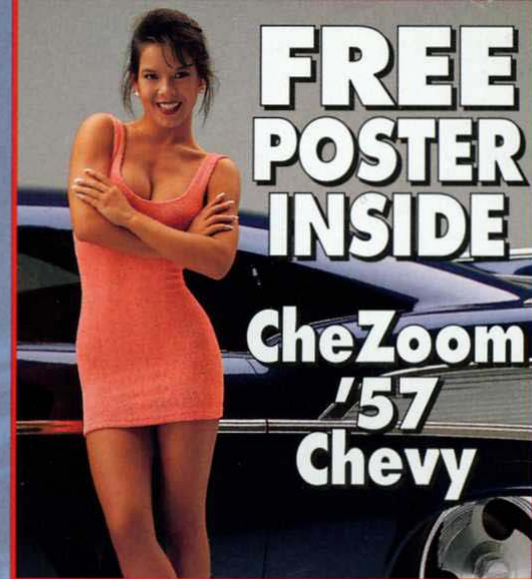
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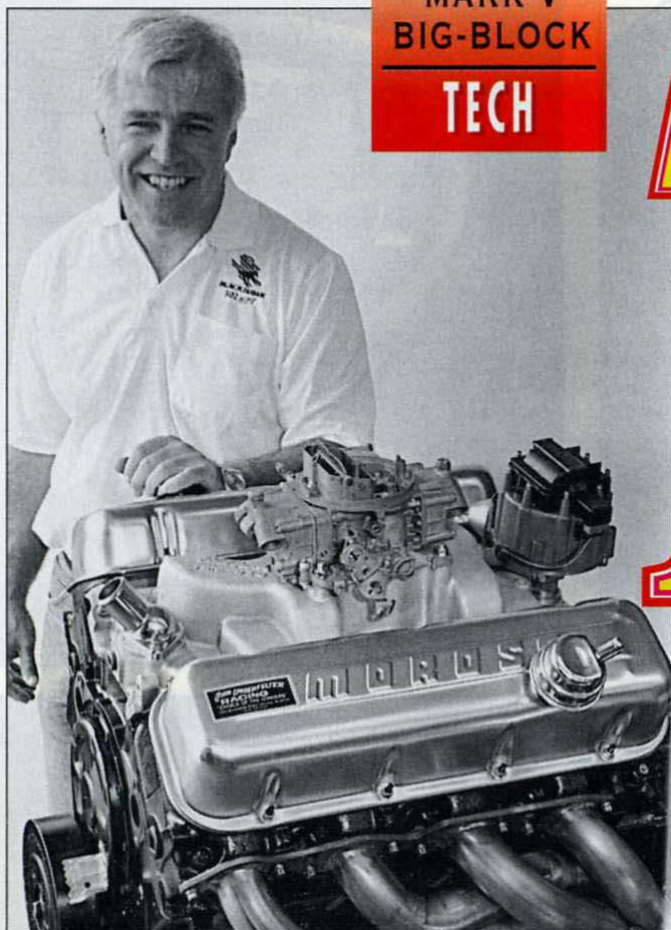
SPECIAL NEWSSTAND EDITION

January 1993 \$3.50



MARK V
BIG-BLOCK

TECH



MAXIMUM RAT

The new Mark V 502 short-block assembly makes a fantastic foundation for either a hot street engine or a max-torque truck motor. There are some significant differences between the Mark IV and Mark V if you are considering swapping in a 502 for an older Mark IV Rat. A new Mark V-design flywheel will be required to fit the new one-piece rear seal flange. The short-block comes with a flexplate. In addition, the Mark V does not offer a mechanical fuel-pump boss. The Mark V also eliminates the clutch linkage ball mounting boss, although Apple Chevrolet offers an adapter. The good news is that Mark IV cams, heads, and intake manifolds still bolt right on!

JOHN LINGENFELTER BUILDS A 660HP, 502CI PUMP-GAS RODENT!

By Jeff Smith

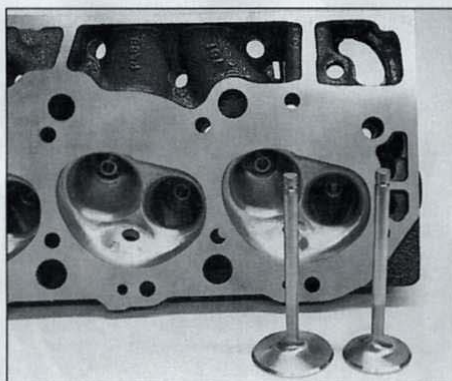
Machiavelli was a 15th century Italian statesman who first proposed the theory that might makes right. Now, Machiavelli never met John Lingenfelter nor did he have a clue about an engine called the Mark V 502 Rat motor. But his theory survives the test of time, especially for Chevy's over-the-counter Maximum Rat. No one builds a serious Rat motor just to putt around town, and Lingenfelter has taken this new big-bore Rat to new levels of hero satus.

We'll quit dancin' here and just give it to you straight: 663 horsepower at 6500 rpm with oval port (yes, that's right, *oval port*) heads, 9.2:1 compression, roller cam, and a 1050 Dominator carburetor on pump gas. That's the serious side. Amazingly, with nothing more than a cam, intake, and carb swap, you could turn this Mark V Rat into a docile everyday street motor that would still make virtually 550 horsepower and over

550 lbs-ft of torque! Sound too good to be true? Read on and we'll show you how easily it's done!

ON THE MARK

In our November '91 issue, we covered the major components of the new generation Mark V 454 big-block with a quick look at the 502 Mark V, including



some dyno testing. The 502 made 550 lbs-ft of torque and 452 horsepower with oval heads and open exhaust, but we felt there was tremendous potential left in this engine. Enter John Lingenfelter. If you look up horsepower in the dictionary, John's picture is right there. The man knows how to make power, especially with Rat motors. He was the first to prove that oval port

Even though we're starting with a big-inch 502 engine, Lingenfelter has found that oval port heads are the hot ticket for sneaking up on 700 hp! These mid-'70s castings were lightly ported with special attention paid to the bowl area under the valves. Standard 2.06/1.72-inch oval port valves are replaced with 2.25-inch intake and 1.88-inch exhaust valves that dramatically increase flow when accompanied with port work. The chambers are smoothed and also trimmed from 122cc to 115cc's, contributing to the 9.2:1 compression ratio.

heads were the right choice for street big-blocks over six years ago with his 496ci Rat stroker motors. As we'll see, this 502 makes power with a vengeance!

The Chevrolet Mark V 502 is essentially a big-bore, standard-454-stroke Marine engine with a 4.47-inch bore and 4.0-inch stroke utilizing a set of custom forged JE pistons, $\frac{1}{8}$ -inch-rod-bolt pressed-forged rods, and a 1053 forged-steel crank spinning in a four-bolt-main block. Since this is the new Mark V version, the rear crankshaft flange features a one-piece rear main seal and oil pan seal, which differentiates this engine from the more familiar Mark IV Rat motors. While those components make the Mark V different, the good news is that the new Rat will accept most of the important bolt-ons like camshafts, Mark IV heads, intake, and exhaust. This set us up for the obvious power test. The short-block was shipped to Lingenfelter's shop in Decatur, Indiana, where his guys began the process of massaging mondo power into this Marine Rat.

RAT PACKING

Lingenfelter's able crew disassembled the short-block as a precautionary measure to ensure all the clearances were where they were supposed to be. After some mild line-honing, they reassembled the 502 with no additional tune-ups. The big concern was the question of fitting Mark IV heads on the Mark V block. Apple Chevrolet offers copper block-deck inserts to be used with Mark IV Fel-Pro head gaskets that will do the job, but just before the engine was assembled Victor Gaskets produced a prototype gasket designed just for this situation that sealed perfectly.

A series of three Competition Cams grinds was selected for the four different test versions of the 502, encompassing virtually the entire range of cam design from a short-duration hydraulic roller, to a slightly longer flat-tappet hydraulic cam for mild street use, up to a thumper mechanical roller cam that made this Max Rat really sing.

Added to this was an interesting combination of two sets of iron, open-chambered, Mark IV oval port heads. The smaller of the two heads is what Lingenfelter calls "peanut" heads because the intake ports are about as big as that salted snack. These 1980s

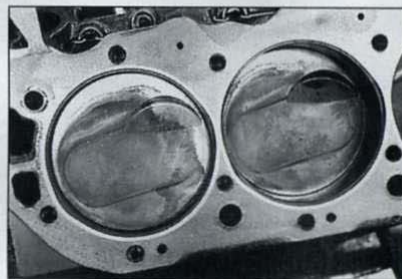
IT'S ALL LIFT AND DURATION

The following are the specifications for the Competition cams used in the four tests on the Mark V 502 Rat.

CAM	DURATION (degrees @ .050-inch)	LIFT	LOBE SEPARATION (angle in degrees)
CB 268-10-280-10HR112 (Hydraulic Roller)	210/218	.566/.595	110
CB 286-3-286-3H112 (Hydraulic flat tappet)	236/236	.556/.556	112
CB CB-296-CR-8 (Mechanical Roller)	260/268	.714/.714	108



Tony McAfee assembled the oval ports heads for the dyno tests. He uses Perfect Circle R18E11F/C Viton rubber valve guide seals to prevent the typical big-block oil control problems. He uses cast-iron guides for durability, keeping the exhaust valve clearance at .0018-inch. Anything less is too tight for iron guides. He also removes the top ring from the PC seals on the exhaust side.



Note the slight piston dome on the monster 4.47-inch-bore JE forged pistons. With only 34 degrees of total ignition lead required, 10.0 to 10.5:1 compression is possible with 92 octane pump gas when using the large roller cam.

vintage heads were used on low-rpm truck engines. John has his cylinder-head guys open these heads up to the typical passenger-car oval port dimension at the intake face, gradually decreasing the port down to its small bowl where a set of oversize 2.25/1.90-inch valves is added. The second set of heads is the typical mid-'70s oval port, open-chamber, passenger-car heads found on mild-horsepower big-blocks. These heads are also massaged with mostly pocket work and blessed with the same 2.25/1.90-inch valves.

The remaining parts used for our testing are typical bolt-on pieces, including Edelbrock's Performer and Performer RPM dual plane intake mani-

folds, Lingenfelter's prototype Stealth multipoint fuel injection manifold, and a Dart single-plane intake for the high-rpm stuff.

THE SPIN CYCLE

The first test was the mondo-torque routine that would best suit a truck application for towing. "Dyno Rob" Vanderhart bolted on the peanut cylinder heads along with the small hydraulic 268 Comp Cams roller, the Edelbrock Performer intake, Holley 750 double-pumper carb, and a set of 1 $\frac{1}{2}$ -inch dyno headers running through open exhaust. As you can see from the dyno chart, 558 lbs-ft of torque at 4000 rpm with a stout 504 horsepower at

COMPONENT	PART NUMBER
502 Mark V short-block assembly	10185059
Mark V Oil pan for early Chevs (Apple Chevrolet)	20
Head Gasket adapter package (Apple Chevrolet)	1017K
Mark IV to Mark V head gasket (Victor)	4918
Performer intake (Edelbrock)	2161
Performer RPM (Edelbrock)	7161
Holley 750 double pumper	0-4779
Holley 1050 Dominator	0-9375

THE NUMBERS

On the left is a list of the part numbers for the major components used in the 502 Mark V dyno tests. There are also additional part numbers for components that may be of interest.

MAX RAT TEST

Test 1

Mark V 502 short-block, 9.2:1 compression, 268 hydraulic roller cam, small "peanut" oval port heads, 2.25/1.90-inch valves, Performer intake, 1-inch open spacer, 750-cfm Holley carburetor, and 1½-inch dyno headers through open

Test 2

Same as Test 1 with addition of Lingenfelter prototype "Stealth" intake with 58mm throttle body. This test was also run through a pair of Camaro 2½-inch Borla stainless-steel mufflers.

Test 3

Same as Test 2 except with large oval port heads and 2.25/1.90-inch valves, 286 hydraulic flat tappet cam, 9.2:1 compression, Performer RPM intake, 1-inch spacer, and 750-cfm Holley carb.

Test 4

Same as Test 3 except addition of larger 296 mechanical roller cam, Dart single plane intake, 1050 Dominator Holley carb, and 2-inch dyno headers through open exhaust.

RPM	TORQUE (lbs-ft)	HP	RPM	TORQUE (lbs-ft)	HP	RPM	TORQUE (lbs-ft)	HP	RPM	TORQUE (lbs-ft)	HP
1600	467	142	1600	469	143	1600	412	126	1600	-	-
2000	479	183	2000	492	187	2000	422	161	2000	441	168
2500	525	250	2500	566	270	2500	439	209	2500	486	232
3000	541	309	3000	606*	346	3000	517	295	3000	500	286
3500	543	362	3500	603	396	3500	548	365	3500	481	321
4000	558*	425	4000	577	439	4000	550	419	4000	529	403
4500	554	474	4500	546	467*	4500	555*	476	4500	582	498
5000	529	504*	5000	485	461	5000	545	520	5000	605*	576
5500	490	503	5500	-	-	5500	523	548*	5500	591	619
6000	-	-	6000	-	-	6000	491	542	6000	563	643
6500	-	-	6500	-	-	6500	-	-	6500	536	664*

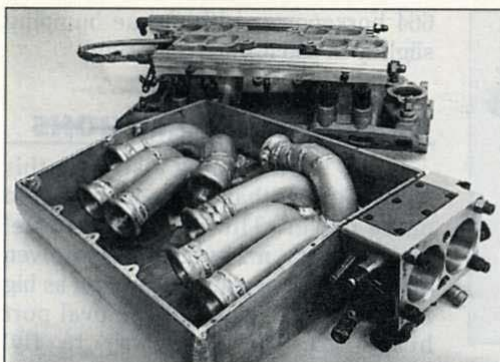
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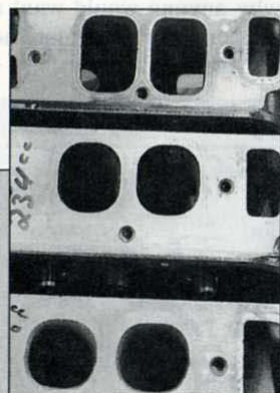
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Accel will soon be casting this Stealth big-block electronic fuel injection manifold for the Rat motor. But for this test, we used Lingenfelter's latest fabricated prototype piece. The base is a cast-aluminum flat-bottom tunnel ram with a fabricated top housing the runner extensions. The extra runner length increases torque, but at the sacrifice of top-end horsepower. This is evident when comparing dyno tests one and two.

If you're prepared to invest the bucks in a 502, then a roller is really the only way to go. While the oval port, flat-tappet hydraulic cam combo made decent power, the mechanical Comp Cams 296 roller really pumped out the power.



From top to bottom: rectangle port, oval port, and "peanut" port truck head intake ports.

HEADS UP!

Lingenfelter's six years of testing have proven that rectangle port heads are generally too big for anything but the most radical of high-rpm big-blocks. From this dyno session you can see that it's possible to make over 660hp from a set of oval port heads, and over 600 lbs-ft of torque from the "peanut" port truck heads! Below we've listed the intake port opening dimensions plus the port volumes for all three heads. It's interesting to note that the peanut head is just slightly larger in volume than a stout small-block head, while the rectangle port head is a massive 89 cc's larger than the oval port. Intake charge velocity generated by the oval port heads is the critical

contributing factor to making big-block power for a street engine.

CYLINDER HEAD	INTAKE PORT VOLUME (stock in cc's)	INTAKE PORT DIMENSIONS (width x height in inches)	INTAKE PORT VOLUME (ported)
Rectangle Port	323	1.710 x 2.370	-
Oval Port	234	1.600 x 1.820	264
Truck Oval "Peanut"	201	1.600 x 1.450	224

5000 rpm is a plenty healthy truck motor!

Taking a giant leap for Rats everywhere, Lingenfelter has recently created the "Stealth" intake, which is a tuned-runner-length, multipoint-electronic-fuel-injection manifold for big-blocks that really cranks out the torque. John bolted this intake on, added a set of Borla stainless-steel mufflers, and pumped an outlandish 606 lbs-ft of torque at a ridiculous 3000 rpm. Of course the trade-off is horsepower, which dropped to 467 ponies at 4500 rpm. This established the potential of the 502 to crank out torque. Now it was time to make some real horsepower.

Keep in mind that there was no magic here. The short-block never

changed except for the cam swaps. For test three, John pulled the peanut heads and replaced them with the slightly larger oval port heads (valve sizes remained the same) and added a longer-duration flat-tappet hydraulic 286 Competition Cams grind with .556-inch lift. This would be typical of a lower-budget street combination with an Edelbrock RPM dual-plane intake and the 750 Holley double-pumper carb. The more direct comparison is test three with test one, where the torque remained essentially the same at 555 lbs-ft, although the rpm peak jumped to a higher 4500 rpm, probably due to the cam swap. The horsepower escalated from 504 to 548 at 5500.

John had one more trick up his

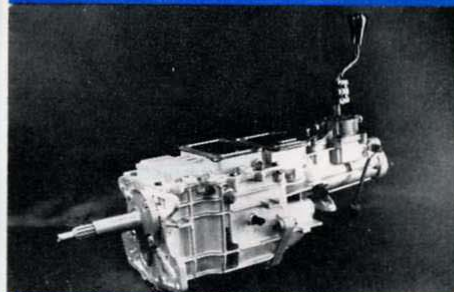
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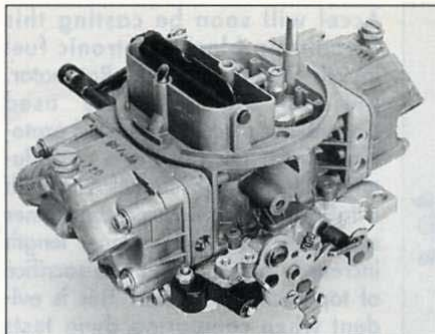
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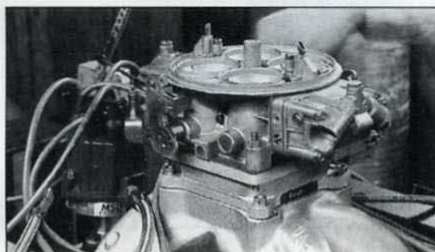
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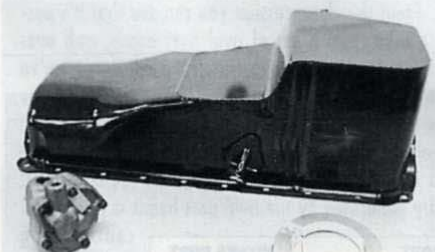
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The venerable Holley 0-4779 double pumper 750-cfm carburetor was an ideal choice for all but the 660 high horsepower combinations.



For the max-power runs on this Maximum Rat, John chose Holley's 1050-cfm 0-9375 Dominator carburetor.



The Mark V uses a different pan that will not fit early Camaros, Chevelles, or second-generation Novas. However, Apple Chevrolet now offers a modified oil pan that will work in these cars along with a specific oil pump.

sleeve to make this Rat really thump. Dyno Rob slipped in a Comp Cams 296 solid roller with .714-inch lift, added stiffer valvesprings, and a Dart intake with an 850 Holley double pumper. The first pull on the 502 really set us on fire since the Rat yanked a steaming 633 horsepower at 6500 and 598 lbs-ft of torque at 5000 rpm! But we weren't finished. John assumed this much airflow through the 850 might create breathing problems so we tossed on a 1050 Dominator Holley with an adapter to the Dart intake. With that swap as the only change, the big 502 thundered, picking up 30 horsepower at 6500 to

664 horsepower with torque bumping slightly to 605 lbs-ft at 5000 rpm!

RATIFIED CONCLUSIONS

If you learn nothing else from this story, believe that oval port heads do make power. The dyno doesn't lie! Lingenfelter's many tests have proven time and time again that, even on as big as 540-inch engines, these oval port heads are the only way to fly! Lingenfelter says that usually a rectangle port engine with the same size valves will often be down 35 lbs-ft and 20 horsepower from the oval port heads. Velocity is the key to why these heads work so well, and they also increase the overall torque curve from idle all the way through the powercurve. It makes you wonder why anyone would want a set of rectangle port iron heads for the street, doesn't it? **HR**

SOURCES

Apple Chevrolet

Dept. HR01
1200 Loucks Rd.
York, PA 17404
717/843-8017

Chevrolet Motor Division

see your local Chevy dealer

Competition Cams

Dept. HR01
3406 Democrat Rd.
Memphis, TN 38118
901/795-2400
800/999-0853 tech line

Dart Machinery Ltd.

Dept. HR01
353 Oliver St.
Troy, MI 48084
313/362-1188

Edelbrock Corporation

Dept. HR01
2700 California St.
Torrance, CA 90503
310/781-2222

Holley Replacement Parts Division

Division of Coltec Industries
Dept. HR01
11955 E. Nine Mile Rd.
Warren, MI 48090
313/497-4000

Lingenfelter Performance Engineering

Dept. HR01
1557 Winchester Rd.
Decatur, IN 46733
219/724-2552

Victor Gaskets

Division of Dana Corporation
Dept. HR01
P.O. Box 455
Toledo, OH 43697
419/891-1900