

Reality Check

Testing stock, ported and CJ 460 cylinder heads on the dyno

text and photography by Earl Davis

Regular readers will remember our story ("CJs Maxed," December '93) on out-of-the-box and ported Motorsport Cobra Jet cylinder heads for the 460 big-block. The aluminum M-6049-A429 castings ran well, but thanks to a \$2600 ready-to-run cost for a pair of fully-prepped and assembled heads, our dyno review caused some readers to slap us back to reality with a few well-taken letters to the editor.

Collectively they said, "What about us regular guys who can only afford stock cast-iron heads? Why not port a set of stock 429/460 heads?" An excellent question, and one we're happy to answer here, along

with revisiting the CJ heads for comparison.

So, we have taken a pair of inexpensive factory production iron DOVE-C heads, dynoed them at JBA Racing Engines for a baseline, then taken them to their limits by porting the runners and installing oversized valves. To keep things in perspective, we also installed a pair of race-prepped A429 CJ heads on the dyno mule without making any other changes. The resulting A-B-C test, or stock vs. modified vs. A429 CJ heads produced some interesting data that should gladden the budget-minded.

DOVE-C iron castings were the first mass-produced heads engineered for N-Code base 429 engines which means they are almost as common as rocks. Big-port Cobra Jet and Super Cobra Jet heads offer more performance potential but, as you'd guess, are rare and expensive. Engineered to deliver big low-rpm torque numbers at the expense of high-rpm horsepower, DOVE heads are durable, heavy and cheap. Pre-'73 versions are even factory equipped with screw-in rocker studs. Later 429/460 heads were cast to accept pedestal mounted stamped-steel rocker arms like the base Cleveland, 351/400M and late model 5.0 liter engines. DOVE heads installed before 11/1/69 are equipped with fully-adjustable rocker studs while castings assembled after

that date have positive stop non-adjustable studs. Although both are true screw-in rocker studs, we recommend replacing the stock studs with high-quality hardened steel aftermarket units for added reliability.

Compared to the 2600 clams required for a pair of race-prepped A429 heads, JBA Racing Engines sells DOVE-C iron castings ported, machined and assembled with quality hardware for around \$1400 a pair. Although that price doesn't include guide plates, rocker studs or shipping costs, it does include the bare castings. Thus a racer can save a little money by supplying his own used heads.

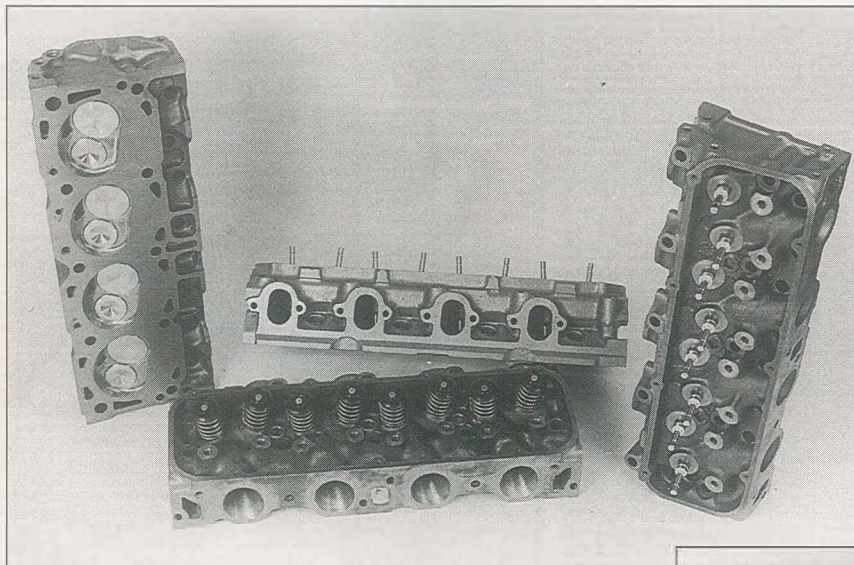
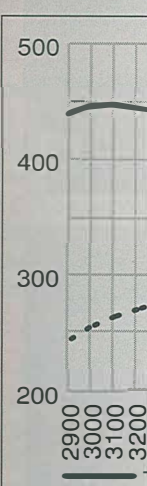
But before spending your vacation money on a pair of stock iron heads, we thought you would like to know how much performance you can realistically expect to gain bolting on a pair of fully-ported DOVE castings. Is it an exercise in futility compared to the output of race-prepped aluminum Cobra Jet heads? To find out, we strapped our 460 dyno mule to JBA Racing Engine's Superflow SF-901 dynamometer and spent the next two weeks exchanging cylinder heads and comparing data.

JBA Racing Engines built our 460 dyno mule about two years ago starting with a '70 vintage 429-cid block. A longer stroke nodular iron 460 crank was substituted for the stock 429 crank after it was magnafluxed, deburred and micropolished, plus a set of TRW L2404-F dished replacement pistons were fitted to the stock 6.605-inch connecting rods. Combining the piston's 17cc dish with the stock, pre-1972 77cc combustion chambers, yielded a streetable 9.4:1 compression ratio. The reciprocating assembly was balanced and blueprinted for added durability. The resulting engine has proved extremely durable during hundreds of dyno tests. Preventative explorations into the bearings and rings showed virtually no wear. So much for the dyno murdering engines.

It's common knowledge almost all Ford cylinder heads are exhaust restricted which means achieving a respectable exhaust-to-intake flow ratio is difficult at best and impossible in most cases. Base 429/460

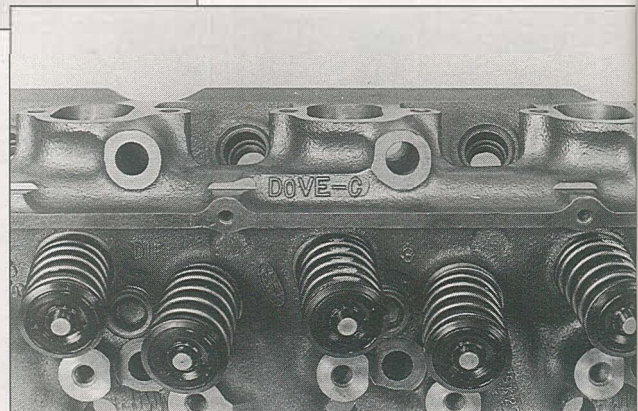
Rpm	T
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3100	4
3200	4
3300	4
3400	4
3500	4
3600	4
3700	4
3800	4
3900	4
4000	4
4100	4

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These dyno tests narrow down the performance value of race porting a pair of stock iron 429/460 cylinder heads. We first dyno tested a pair of stock iron heads, then without making any other changes, replaced them with a pair of ported heads equipped with larger valves. And, to see how the ported stockers stack up, we installed a pair of race-prepped Motorsport A429 aluminum CJ heads on the 460 dyno mule, again without making any other changes.

To ensure inculpable results, we acquired two pair of stock DOVE-C castings. A good valve job and standard-size stainless steel valves and they were ready to run.



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But before spending your vacation money on a pair of stock iron heads, we thought you would like to know how much performance you can realistically expect to gain bolting on a pair of fully-ported D0VE castings. Is it an exercise in futility compared to the output of race-prepped aluminum Cobra Jet heads? To find out, we strapped our 460 dyno mule to JBA Racing Engine's Superflow SF-901 dynamometer and spent the next two weeks exchanging cylinder heads and comparing data.

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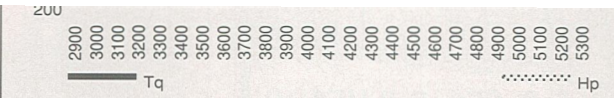
It's common knowledge almost all Ford cylinder heads are exhaust restricted which means achieving a respectable exhaust-to-intake flow ratio is difficult at best and impossible in most cases. Base 429/460

2900	477.10	359.57	5300	451.90	456.03
4000	472.10	359.57	5300	451.90	456.03
4100	474.53	370.47			

heads are no exception. There is no way to enlarge the exhaust passages enough to bring the exhaust flow in line with the intake because there simply isn't sufficient material around the exhaust port. In our stock D0VE-C heads, for example, the unported exhaust runner flowed 53 percent as much air as the unported intake at maximum valve lift. An ideal exhaust ratio would be closer to 75 percent.

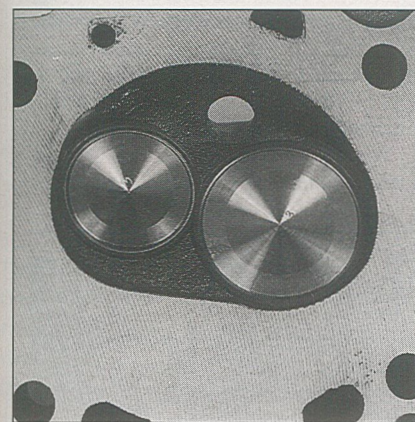
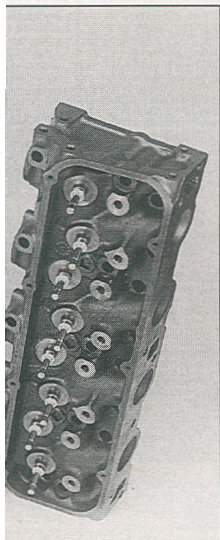
After porting, the ratio increased to only 58 percent, primarily because the intake ports also respond favorably. The amount of airflow through both the intake and exhaust runners increased proportion-

ally after porting. In fact, according to John Bridges, JBA Racing Engine's master head porter, as much can be gained by concentrating all of your efforts on the exhaust port and leaving the intake alone. "Without expensive welding, cutting and grinding, there is no physical way to obtain an ideal exhaust to intake flow ratio," he said. The flow charts printed below details what we gained by porting the stock heads:

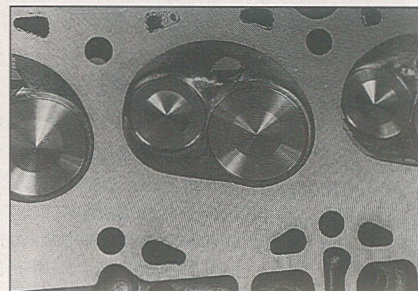


Stock D0VE Head

Lift	Intake		Exhaust	
	Cfm	Cfm	Cfm	Ex/In %
.050	34.46	27.35	.80	
.100	68.01	56.26	.83	
.150	103.94	91.33	.88	
.200	138.48	104.72	.76	
.250	174.70	118.10	.68	
.300	207.28	128.18	.62	
.350	230.97	136.37	.59	
.400	245.77	141.41	.58	
.450	257.61	143.61	.56	
.500	268.27	144.56	.54	
.550	275.97	145.82	.53	
.600	281.30	145.82	.52	



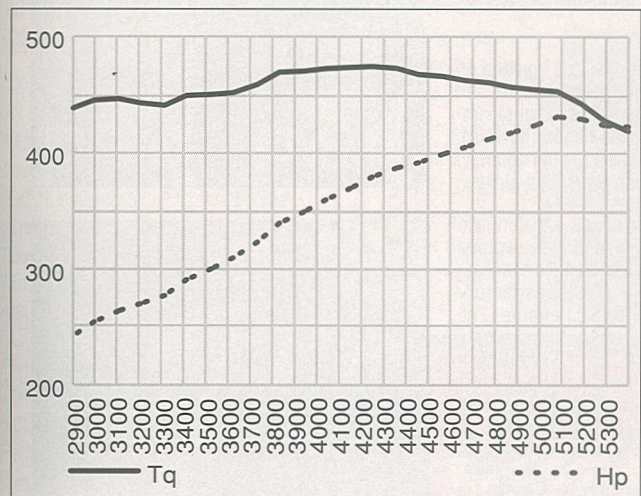
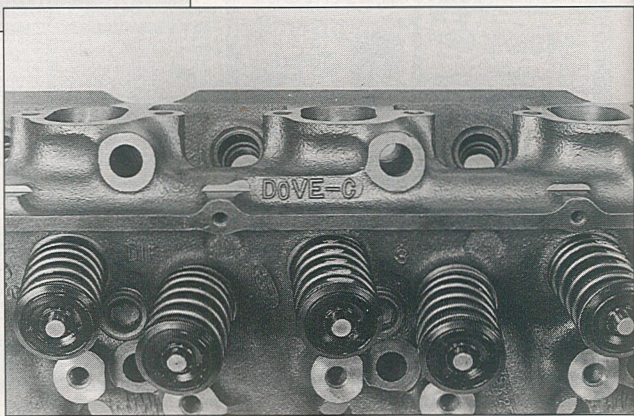
One pair was treated to a quality valve job and their gasket surfaces were milled flat. Otherwise they were unmodified right down to the stock 2.080-inch intake and 1.650-inch exhaust valves.



Ported D0VE Heads

Lift	Intake		Exhaust	
	Cfm	Cfm	Cfm	Ex/In %
.050	34.36	29.69	.86	

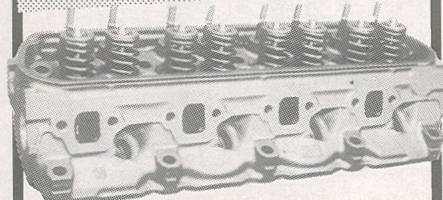
Combustion chamber volume was held to 77cc to ensure each pair of heads would produce the same compression ratio. The ported D0VE heads shown were machined to accept oversized 2.190-inch intake and 1.735-inch exhaust valves. These castings will accept even larger valves but, according to John Bridges, the modification is pointless given the size of the runners.



Stock D0VE Heads

Rpm	Tq	Hp	Rpm	Tq	Hp
2900	438.53	242.13	4200	474.43	379.40
3000	445.30	254.33	4300	472.97	387.23
3100	446.67	263.67	4400	467.70	391.83
3200	443.00	269.93	4500	466.03	399.30
3300	440.90	277.03	4600	462.63	405.20
3400	449.43	290.93	4700	460.70	412.27
3500	450.27	300.07	4800	456.83	417.50
3600	451.77	309.67	4900	454.67	424.17
3700	458.97	323.37	5000	453.20	431.47
3800	469.53	339.70	5100	442.27	429.47
3900	470.40	349.33	5200	428.33	424.10
4000	472.57	359.90	5300	418.97	422.80
4100	473.63	369.73			

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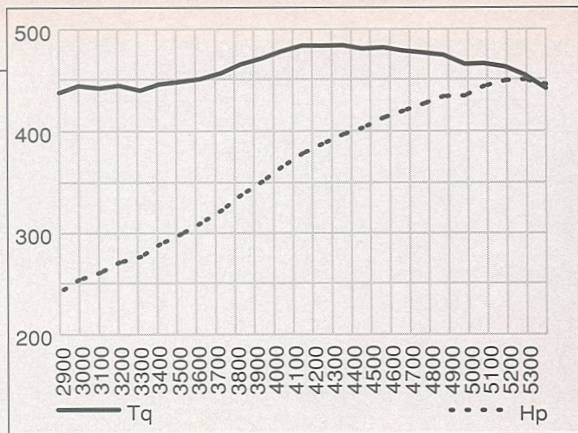
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	1.60w/long tip	\$69.00 set
Cleveland	1.710	\$69.00 set
	2.190	\$69.00 set
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	2.245	\$79.00 set

Complete Porting, Polishing,
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Custom Head Welding, Cast Iron
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Reality Check



Ported DOVE Heads

Rpm	Tq	Hp	Rpm	Tq	Hp	Rpm	Tq	Hp
2900	437.97	241.87	3800	465.70	336.97	4700	477.13	426.97
3000	444.80	254.07	3900	471.67	350.23	4800	474.90	434.03
3100	442.37	261.10	4000	478.53	364.47	4900	465.87	434.67
3200	444.97	271.13	4100	484.23	378.00	5000	466.47	444.10
3300	440.13	276.57	4200	484.10	387.13	5100	463.20	449.80
3400	446.33	288.93	4300	484.60	396.80	5200	455.27	450.77
3500	448.87	299.00	4400	481.20	403.13	5300	441.87	445.90
3600	451.27	309.30	4500	482.30	413.23			
3700	457.23	322.13	4600	479.17	419.70			

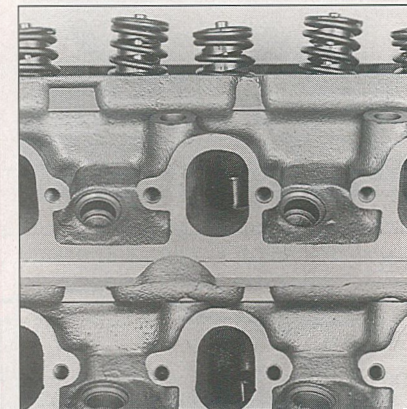
Intake Exhaust

Lift	Cfm	Cfm	Ex/In %
.100	70.29	59.38	.84
.150	109.77	92.12	.84
.200	146.57	119.05	.81
.250	185.07	135.74	.73
.300	216.75	149.28	.69
.350	244.59	162.71	.67
.400	269.46	167.45	.62
.450	286.04	170.61	.60
.500	299.26	173.77	.58
.550	303.72	176.93	.58
.600	308.19	180.09	.58

A dual-pattern camshaft can somewhat improve a poor exhaust flow ratio by opening the exhaust valve further and holding it open longer in relationship to the intake valve. With that in mind, Competition Cams ground a dual-pattern camshaft specifically for this series of

The ported DOVE castings (top) picked up 27.77 cfm of airflow on the intake side and 31.11 additional cfm through the exhaust runners over the stock unported heads (bottom).

Tapered stem SI valves further reduced restriction which enhanced airflow



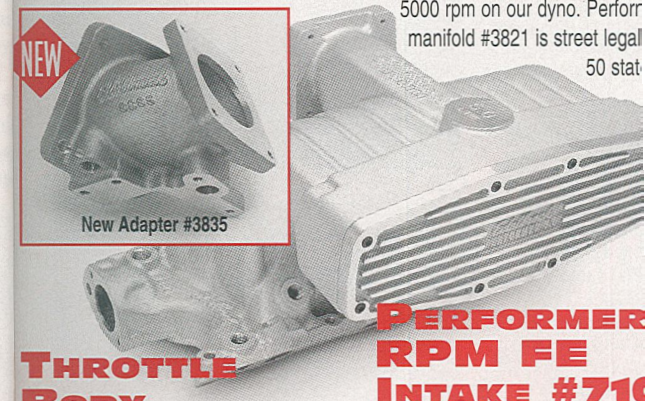
tests. The part number, 34-000-5, denotes a 429/460 cam blank. The grind number, FF 280-3/288-9 H12, contains the profile specifications. Intake gross valve lift of our dyno cam measures .529-inch while the exhaust is opened .557-inch. Intake and exhaust duration at .050-inch is 230/237 degrees respectively. The H12 indicates a 112 degree centerline.

We chose Offenhauser's Port-O-Sonic intake manifold for this test series

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The Performer's modular design incorporates the latest technology for maximum power gains—up to 37 hp at 5500 rpm—with no loss of low speed torque. Our new Throttle Body Adapter #3835 and Strut Tower Brace #5225 allows installation on 1994-95 Mustangs. With a broad power range of 1000 to 6000 rpm, this manifold alone produced a remarkable 4/10ths second improvement from 0-60 mph on a 1994 Mustang. Gains in mid-range power and throttle response are unbelievable. For even more horsepower, match with Edelbrock 5.0 heads, 70mm throttle body (and EGR plate on '86-93), Performer-Plus 5.0 cam, Tubular Exhaust System, RPM Series Cat-Back exhaust. This Total Power Package made a 65 hp gain



NEW THROTTLE BODY ADAPTER

This aluminum adapter relocates the throttle body to allow the use of our #3821 manifold on a 1994-95 Mustang. Works with stock or Edelbrock/BBK throttle bodies. Requires Brace #5225. 1994-95 Mustangs.....#3835

THROTTLE BODIES

Edelbrock/BBK throttle bodies match our #3821 manifold and adapter #3835. 70mm is recommended for use with our Power Package on a 1994-95 Mustang.

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Designed for 390-427-428 Fords, new #7105 has a broad power range that's ideal for street high-performance. It offers upper-rpm horsepower without losing low-end throttle response and represents the latest technology in intake design. Dyno tested on a 1994-95 Mustang, it produces a 427 medium riser produced 50 hp and 24 ft/lbs. more torque than the Ford "Sidewinder". These test results were with our new Performer Power Package on a 1994-95 Mustang.

Reality Check

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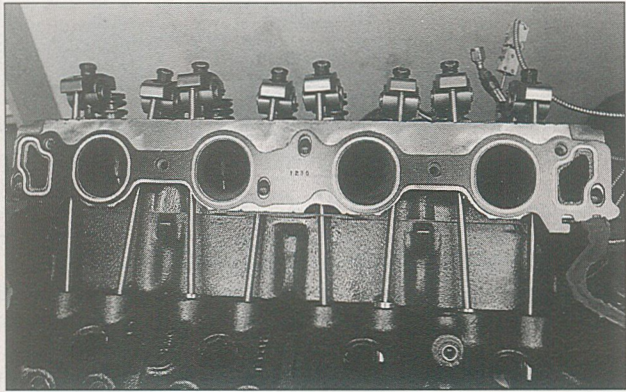
because it best suits the application and it is the only manifold that can be port matched to either the smaller stock intake runners or the larger CJ inlet ports. You may recall our 460 "Intake Inquiry" in the February '93 issue where the single-plane Offy didn't come off so well compared to the big dual-plane competition when all the intakes were run box-stock. That was our mistake in some respects, as the Offy is sold with porting in mind. Thus, out-of-the-box it's only so-so, but once ported it makes power, as this test shows.

A baseline was set with a pair of stone-stock DOVE-C heads installed on our 460 dyno mule. Except for a quality valve job, the ports in the stock castings were untouched. All three pairs of heads; the

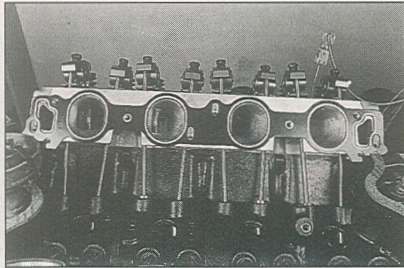
stock DOVE, ported DOVE and the race prepared A429 Cobra Jet heads, were equipped with SI stainless steel valves, Competition Cams 924-16 valve springs, 741-16 1.550-inch diameter steel retainers, 611-16 Super Locks, 503-16 11/32-inch Teflon valve stem seals, Motorsport M-6566-A429 guide plates and Motorsport M-6527-A331 rocker studs.

When the dust settled and the 64 dyno sheets were tabulated and the runs averaged, it turned out our dyno mule made some nice numbers. For starters, the engine opens the dyno sheets at a loafing 2900 rpm with over 435 ft/lbs of torque and 240 hp every time. You gotta love big-blocks. Our peak numbers came with the aluminum A429 heads, of course. They topped out with 484 ft/lbs of torque and 450 hp, clearly, more camming and

The printed data illustrating the performance of each pair of cylinder heads is averaged from a minimum of three back-to-back dyno passes. The timing and carburetor jetting was not changed once testing began. It was necessary, however, to install sparkplugs one heat ranger colder than stock when running the iron heads and two ranges hotter when the aluminum heads were installed.

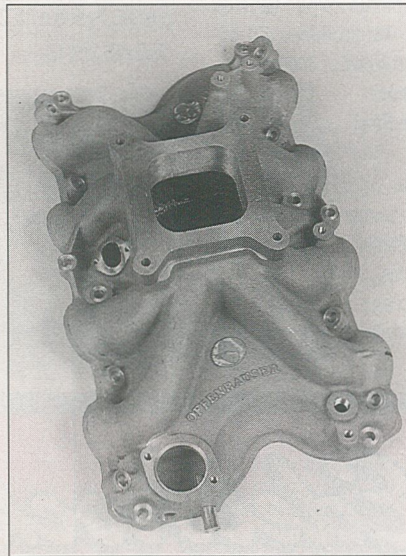


It's typically the small things that cause the headaches, and with these different 460 cylinder heads, getting the right intake gaskets is important. We installed Fel-Pro 1230 gaskets when combining a small-port intake with a pair of base 429/460 heads.



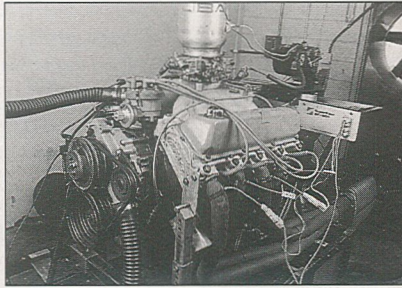
Install a pair of Fel-Pro 1231 gaskets when combining a large port intake with a pair of CJ/SCJ heads (aluminum or steel), or when combining a large-port intake with a pair of base small-port heads. The same intake and head gaskets were used through three equipment changes without suffering a failure or leak.

A single-plane Offenhauser Port-O-Sonic manifold was used in all tests partly because its rpm range best suited our application and partly because it is the only 385 Series manifold that can be gasket matched to small-port base 429/460 heads or extra large CJ/SCJ runners.



compression would have better showcased these heads. As for our porting work, grinding on the stock heads turned out to be worth 19.3 horsepower and 10.2 ft/lbs of torque spread over a 2800 to 5100 rpm range. To quote a well-documented disclaimer, "results may vary depending on the equipment used."

Our A429 heads were worth a paltry 5.3 hp and 1.9 ft/lbs of torque over the ported stockers — again, more camming would have shown a larger difference. Just the same, it's clear a set of early stock heads with a good port job can hold their own on budget engines. Of course, this doesn't take into consideration the additional power the A429 heads have in them, nor do the considerable handling and speed benefits of aluminum come into play on the dyno.



Sources:

Competition Cams, Inc.
3406 Democrat Rd
Memphis, TN 38118
(901) 795-2400

Fel-Pro Incorporated
7450 North McCormick Blvd.
P.O. Box 1103
Skokie, IL 60076
(708) 674-7700
(708) 674-5816 fax

Hooker Industries, Incorporated
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