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| How-To - Engine and DrivetrainNov 16, 2011See all 17 photosWhile the 427 FE engine often gets its share of fame when seen between two Mustang fenders, the Boss 429 is probably equally as popular. For a while, though, it was easier to build a 427, but thanks to Jon Kaase Racing Engines, it's now more feasible to put the monstrous Boss engine back into your Mustang or classic Ford vehicle.Mark Kassab, a previous B2 Motorsports customer, contacted B2's Brent Lykins about building a Boss 9 engine for his Boss 429 Mustang clone. As Lykins had built a pretty stout 427 small-block for Kassab's Cobra replica, Kassab wanted to see what Lykins had for the Mustang as well.It goes without saying that a Boss 429 clone deserves a Boss engine, right? Beyond that, Kassab had three criteria that the engine had to meet.Streetability-the engine had to run on 91- to 93-octane pump gas. It also needed to be docile to the point where a cruise-in or parade would be a pleasure instead of a burden. The engine would have to run full accessories, including air conditioning as well.Horsepower-a muscle car deserves muscle. Mark wanted 500 to 600 hp with comparable torque.Style-The goal here was to not go nuts with chrome and polished aluminum, but to have something that would most definitely be an eye-catcher.With a plan laid out, Lykins let us in on the build so we could show you what is involved with creating such a potent powerplant. The build is in the details, and the more thought that you or your engine builder puts into an engine, the better the results will be, and the happier that you will be. That said, we're going to walk through the decisions that were made (and why) regarding this Boss 529 engine build. The foundation of any engine build is the block. Careful attention needs to be paid here in both block selection and machine work, especially when aiming for large horsepower numbers. For instance, it's not a good idea to shoot for 600 hp with your production 302 block, for you soon may find that you own two halves of an engine instead of a whole engine. With this build, the goal of building a Boss 9 engine limits us to a 385 series engine block-i.e. a 429 or 460. When prepped well, a production 460 block will provide a very good basis for major horsepower production, and given the horsepower goal for this application, that is what Lykins started off with. The D1VE 460 block was magnafluxed, and pressure-tested prior to any machine work. For added insurance, Lykins switched the factory main bolts to ARP main studs.Staying with the underlying goals, Lykins chose to go with a forged crankshaft, H-beam rods, and, of course, forged pistons. This engine is expected to make at least 700 hp at a very streetable rpm."In my mind, a cast Scat crankshaft and forged I-beam rods would undoubtedly hold this amount of horsepower," notes Lykins, "however, for growing room, added protection, and overall engine value, I went with a forged 4340 4.300-inch-stroke crankshaft and forged 6.800-inch H-beam connecting rods."For the pistons, the slugs had to fill the cavernous 4.420-inch bore and fit the Kaase Boss 9 cylinder heads, but they needed to provide the correct chamber volume (flat-top, dome, dish, or inverted dome) to work with the established parameters. Streetability means it needs to run pump gas, so Lykins decided on a 10.75:1 SCR (static compression ratio)."I found that with an 87cc combustion chamber, a 4.500x0.040-inch head gasket, and a plan to put the pistons 0.005-inch in the hole, we would need a piston volume of about 12 cc's," says Lykins of the Diamond forged slugs. With the short-block squared away, it's time to address the cylinder heads. Building a Boss engine requires Boss heads, plain and simple. Coming up with a set of vintage Boss 429 heads would not be a small feat. Luckily, Jon Kaase has been reproducing them for a few years now. Featuring 87cc heart-shaped combustion chambers, 2.300-inch intake valves, and 1.900-inch exhaust valves, these heads move some serious air (more than 400 cfm out of the box on the intake side). Normally, when building a street-only engine, you have to pay attention to cylinder head intake port volume. When very large port volumes show up, port velocities can go down, making an engine less responsive or fussy in the lower rpm range and in part-throttle situations. However, in this case, 529 cubic inches of volume will help tame larger camshaft sizes, larger port volumes, and single plane intake manifolds.Since we're going to be running a hydraulic roller camshaft (more on that later), the heads need to be fitted with the proper valvetrain parts to support that decision. For heavier valvetrain components used in Fords, Lykins prefers 160-170 pounds of seat pressure on hydraulic rollers, with around 385-400 pounds of open pressure. Springs need to be selected based on the spring's installed height, and all other valvetrain components (spring locators, retainers, locks, and shims) need to support the springs that will be used. Once more, keep details in mind here based on what you want the engine to do and what rpm range you want the engine to run in without issue. On street cruiser engines, Lykins prefers to limit the peak hp to around 5,500-6,000 rpm. This generally provides a lot of power available down in the low- and mid-rpm ranges, and encourages higher and broader torque curves. Following this line of thought, there's no use in absorbing the risk of running a solid roller camshaft for such low rpm ranges. A hydraulic cam will work just fine in this scenario and will help ensure a lower maintenance plan for the engine."For our Boss 529, which is going to be driven a lot in a stop/go scenario, through cruise-ins, through parades, and so on, we need a less fussy engine with great bottom end characteristics and a broader torque curve," says Lykins. As far as the intake manifold, there are only a few choices from Jon Kaase to match the cylinder heads. He offers a nice single-plane intake, similar to the Edelbrock Victor 460 intake. It's offered in either a 4150 or a 4500 (Dominator) flange. Normally, a single-plane intake isn't the best choice for a street engine. But as we talked about before, a large displacement engine can help keep the air/fuel mixture velocity up, which greatly lessens the poor off-idle and low-rpm manners that can be exhibited by using a large intake with a small displacement. In addition, Jon has the intake manifolds cast with a port tongue in the floor. This raises the floor of the intake runner, helps increase velocity, and helps angle the incoming mixture toward a more desirable position in the cylinder head port. Carbs need to be chosen with the driving style in mind as well. Along with cams, intakes, and heads, carburetors tend to be selected that are a little on the large size. This can lead to poor throttle response and situations where the air/fuel tuning is a little harder to nail down. A 529 cubic inch engine needs to be fed appropriately and the 4150-style carburetors usually cap out at around 950-1,000 cfm. For our Boss 529, we chose to go with a Dominator-style flange on the intake manifold and we will be running a Quickfuel Technologies 1,050-cfm dominator- style carburetor. The width of a big-block with Boss 9 heads will rain on a lot of parades. Not only will it completely fill up the engine bay of a vintage Mustang, but it will also ensure that you can't physically fit the engine on a lot of dyno carts. The issue isn't the size of the engine itself, but it's the fact that normal headers will hit the upright stands used to bolt the engine to the cart. We had even borrowed some dyno headers from Jon Kaase's shop, but to no avail.So how many dynos did this engine see? Three. The headers hit the dyno cart on the first dyno (an older Stuska). At the second dyno shop, we had to turn the headers upside down for it to fit (a DTS dyno) and if you turn the headers upside down, it blocks about of the exhaust port. The owner of this engine (and the '70 Boss 429 Mustang clone that it's going in) Mr. Mark Kassab, resides in the Florida panhandle, so we made arrangements to meet halfway at Jon Kaase's shop in Winder, Georgia.After an hour of bolting the engine up to the dyno cart, we were ready to light a fire in the beast. Mixture screws were set, float levels were checked, and the ignition timing was set with some advance so it would start quickly. A couple revolutions of cranking and our Boss 529 came to life and settled into a running rpm. Total timing was set with a timing light (finally settling in at 33 degrees total time at 2,800 rpm) and the engine was run with a light load on it for a little run and break-in time before getting down to business.Lykins's preferred dyno regimen includes a lower rpm, short pull initially, just as a shakedown pass. A quick spin up to around 5,000 rpm to listen for anything abnormal, check A/F ratios, get a good baseline, and then shut it down.Pulling to the meager 5,000 rpm offered up a stout 680 hp. We really could have stopped right there, but the engine sounded like it had just got up on the cam, so we had to pull a little higher. Lykins was expecting a peak hp rpm of around 5,800-6,000 rpm, so we knew it had a little more left in it. From there on, the engine was pulled from 3,500-6,500 rpm. What did we end up with? How about 740 hp at 6,000 rpm and 700 lb-ft of torque at 4,800 rpm? Even at our starting rpm of 3,500, torque was more than 620 lb-ft. What a monster. So did we meet all of our goals that we outlined in the first part of this article? If you can recall, we set three goals: 1. Streetability, 2. Horsepower, and 3. Style.In terms of streetability, we pretty much hit the nail on the head. This is an engine that will idle at 950 rpm, run (hard) on pump gas (dyno pulls were made with 93-octane), pull enough vacuum to run power brakes, and have enough torque available off idle to pull a stump out of the ground. As Lykins put it, "Mark has a gooseneck car hauler that he pulls around. I suggested that he just mount a fifth wheel to the top of his Mustang as the 529 would have enough torque to lug almost anything around."Do we really need to say anything about horsepower? We had 740 hp at 6,000 rpm. Keep in mind here that we didn't have to spin the engine to the moon to make power. That's the benefit of a large displacement engine and ultra-high-performing cylinder heads. At 3,500 rpm, we were at more than 400 hp. At 4,800 rpm, we had already surpassed Chevy's Corvette ZR1 638hp rating.We have an engine that's as wide as a double-wide trailer, with silver powdercoated valve covers, a silver powdercoated intake manifold, polished aluminum accessory drives, a gorgeous Ford blue engine block, and enough anodized aluminum to accentuate the other colors. When Mark throws open the hood to his '70 Boss 9 clone, we suspect a lot of jaws will drop. We think Lykins easily accomplished the style request. See all 17 photos1 This is a production D1VE 460 block that B2 Motorsports' Brent Lykins opted to use as the basis of the buildup. It features a 4.420-inch bore, and is more than capable of handling the prospective power output.See all 17 photos4 In this photo, you can see the Clevite V-series main bearings have been installed, and the rear main seal has been set, making sure that the lip goes toward the front. Clevite's H-series rod bearings were also employed.See all 17 photos7 The shiny slugs are custom pieces from Diamond Pistons. They fit the 4.420-inch bore, 4.300-inch stroke combination and feature a 1.350-inch compression height and a 12cc dish. Mahle 4.420-inch piston rings were used as well.See all 17 photos10 The key to offering performance enthusiasts a chance to own a Boss 9 engine is these Jon Kaase Boss 9 semi-hemispherical big-block Ford cylinder heads. They are assembled with Comp Cams Viton valve seals, Comp Cams dual valvesprings, and Comp Cams tool steel retainers.See all 17 photos13 Trimming out the engine, Lykins installed an Edelbrock aluminum water pump, MSD Pro Billet distributor with a bronze distributor gear, Kaase Boss 9 plug wires/looms, a Melling HV oil pump with ARP pump drive, a Moroso dual-sump oil pan/pickup, and, of course, Jon Kaase Boss 9 valve covers.See all 17 photos15 Jon Kaase Racing Engine's senior engine builder, Chuck Lawrence (left), and B2 Motorsports' Brent Lykins (right) prep the engine for a thorough thrashing on the engine dyno at JKRE.Share on FacebookShare on Twitter

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