

With the right gearing and internal mods, Chevy's 302-inch mini-monster has Top Street Eliminator and class champ potential. Here's all you have to know to turn a stocker into a **Z-28 Giant Killer**



Chevy Z-28 mill utilizes component parts proven on earlier HP Corvettes-plus new goodies.

TO BUILD a 302 cubic inch engine for heavy duty service, it's best to start with an RPO Z-28 Engine Assembly #3923217 (1967 Engine #3916355). This engine is of high performance design featuring: forged high-compression 4-inch pistons; 3-inch stroke specially heat-treated crankshaft with 8-inch harmonic balancer, (for 1968, main and connecting rod journal sizes were increased on all small-block Chevrolet engines); *selected* high-quality connecting rods; large-port heads with 2.02-inch intakes and 1.60-inch exhausts; tuned aluminum high-rise manifold, 800 cfm Holley carb; special oil pan baffling, deep-groove belt pulleys, and a .455-inch lift solid cam with

Front spoiler developed for Trans-Am road racing is a boss street image goodie. Reverse scooped hood works with Ram Air carb kit.



special push rods and rocker arms. Partial or short block engine numbers for the 302 are #3917263 (1967) and #3933047 (1968).

In addition, a 302-cube engine may be built using any 327 (4-inch bore) crankcase and a 283-cube (3-inch stroke) crankshaft and the various component parts described in the following text.

RECOMMENDED CLEARANCES

Piston-to-Bore

.0055-.0065 measured at centerline of

wrist pin hole, perpendicular to pin. Finish bores with #500 grit stones or equivalent (smooth).

Wrist Pin

.0004-.0008" in piston, .0003-.0005" in rod (for floating pin).

Rod Bearing

.002-.0025", side clearance .010-.020.

Main Bearing

.002-.003", minimum preferred,

.005-.007 end play.

Piston-to-Top of Block

(Deck Height)

.010-.015" average below deck. No part of piston except dome to be higher than deck of block. Deck height specified is for a .025" steel head gasket. If thicker head gasket is used, deck height may be reduced accordingly.

Valve Lash

.030 int., .030 exh. for production cam #3849346. .022 int., .024 exh. for optional service camshaft #3927140.

Valve-to-Piston

.010 Intake, .020 Exhaust checked at zero lash during valve overlap cycle. These are absolute minimum clearances to allow for heat expansion only and will not accommodate valve float from over-revving.

BLUE PRINTING PROCEDURE

Cylinder Block

Inspect, clean and de-burr. Normal procedures except smooth bore finish. Main bearing caps *should fit tightly* into case notches to prevent cap misalignment. Additional main bearing bulkhead durability may be achieved by using studs instead of bolts in the three intermediate main bearing caps. Studs should fit snugly the full length of the block threads and should be installed with Loc-Tite for better retention.

Crankshaft

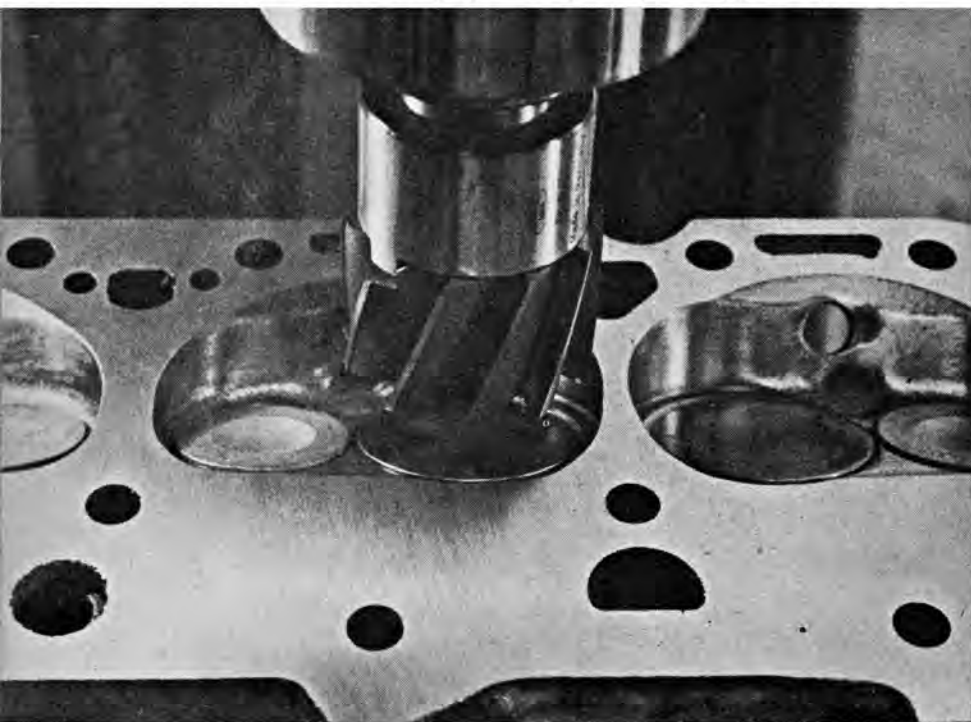
Remove any burrs from oil holes and passages and polish journals with #400 sandpaper. The production 302 crankshaft is "Tuftride" heat-treated to improve journal hardness and give greater fatigue strength for high rpm drag durability. This feature is an improvement to any high performance forged crankshaft.

Connecting Rods

Connecting Rod #3927145 (1967) and #3923282 (1968) are high quality production parts with improved surfaces between rod and cap. In addition, they are heat-treated to a higher hardness and magnafluxed to be sure they are free of flaws. All other rods should be magnafluxed before using. Connecting rod durability can be improved by performing the following operations: Round *all* sharp edges of I-beam of rod and grind off excess flashing where forging dies came together along sides of rod. It is not necessary to remove all this flash or polish the rod, but all grinding should be *lengthwise* of the rod and finish gasket with aluminum paint for sealer, or composition gasket without sealer. Torque head bolts to 65 ft. lb. It is recommended that rocker arm studs be pinned to keep them from pulling out or replaced by screw-in studs.

engine was designed specifically for TRANS-AM

Heads should be cc'd and treated to a progressive-angle competition-type valve job.



For best street performance, Camaro should be dyno tuned and fitted with tube headers.



SUPER TUNING

Topcat Kit

The simplest route to increased performance is the via the TOPCAT bolt-on horsepower kit. It's good for an honest 10-percent rear wheel horsepower gain. The kit includes special blocked heat riser gaskets, selected-range spark plugs, the right carburetor jets, 7500-rpm points, heat spacers, a custom-calibrated ignition curve kit, all the gaskets you need and complete-tuning instructions

compiled by the leading supercar dyno-tune specialist in the country.

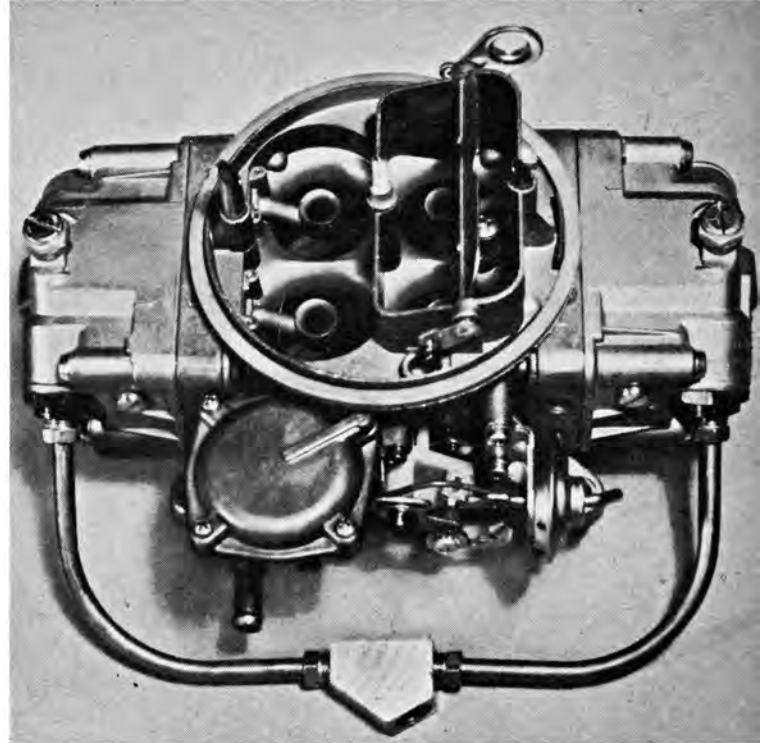
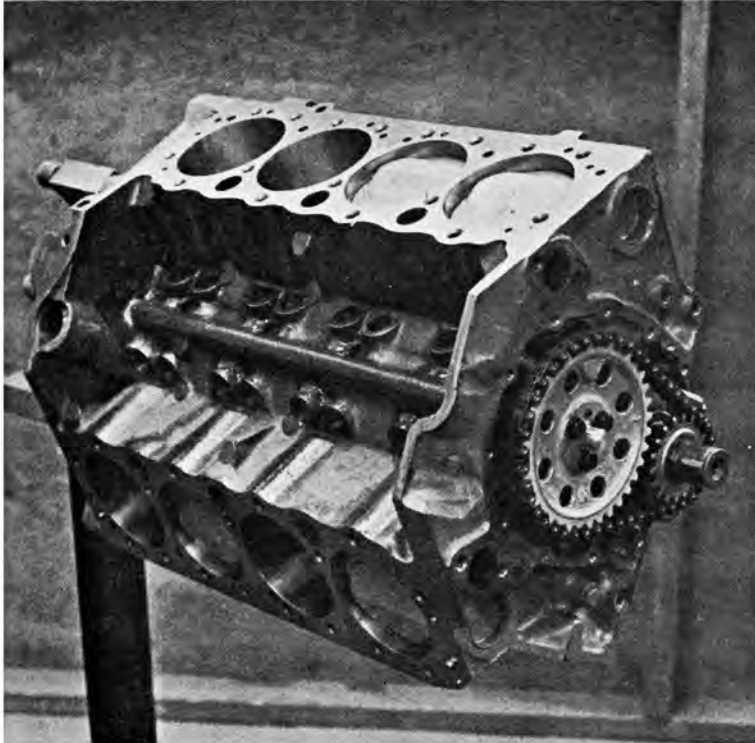
Camshaft

OK as is; use nylon-toothed cam sprocket. Production Z-28 Camshaft is #3849346 with .455-inches lift and is to be hot-lashed at .028-inch for both intake and exhaust valves. Optional camshaft #3927140 is a long-duration .473-inch intake and .492-inch exhaust lift higher performance cam and is *not* recommended for use on the street. It should be installed with #3927142 valve

springs and hot-lashed .022-inch inlet and .024-inch for exhaust valves. It is recommended "Molykote", or other molydisulfide based EP lubricant be used on camshaft lobes for proper break-in. In addition, valve lifters will be more compatible with the camshaft if you polish the contact surface with #600 grit sandpaper before installing them. Good used lifters that still retain some crown or convex curvature across the bottom are very satisfactory.

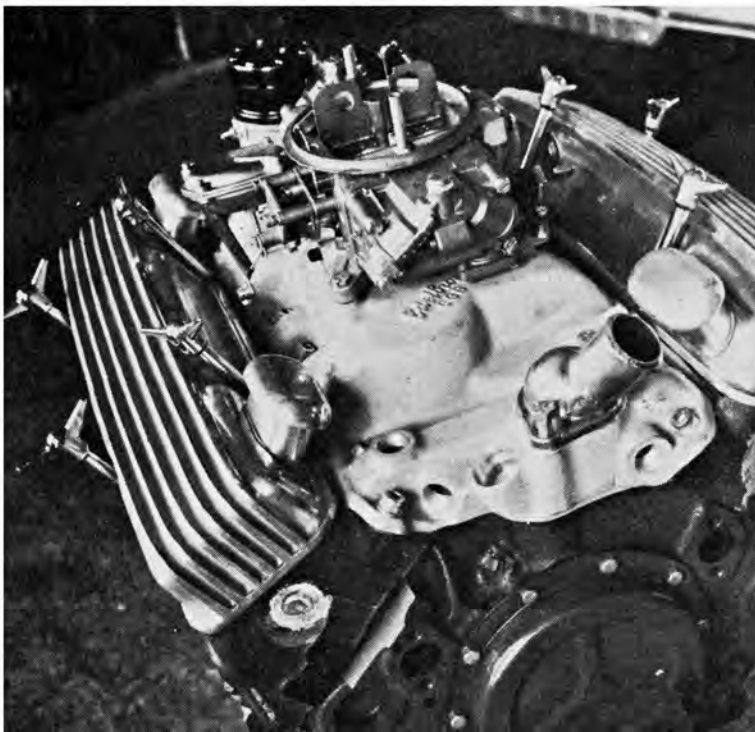
Block to use is the latest model with new crank and four-bolt mains.

Stock carburetion is 800-cfm Holley on an aluminum throne.



Hot setup is the Holley 950-cfm three-barrel on an Edelbrock manifold.

Expensive optional ram quad setup is for racing-only.



ground very smooth. Round all sharp edges around the rod bolt head and nut seats, and smooth out any nicks in the radius of the bolt and nut seats with a small grinder.

Have entire rod, including bolt and nut seats, shot peened. The big end of rod should be carefully reconditioned in a Sunnen rod reconditioner if necessary. Install with a new magnafluxed bolts and nuts. Torque 1967 or earlier rod with 11/32" bolts to 35 - 40 ft./lb. Torque 1968 rods with 3/8" bolt to 45 50 lb. If elimination of production pressed-in-wrist pin design is desired, rework connecting rods for full floating pin assemblies.

Pistons

Smooth sharp edges off domes for

better flame travel. For installation of rods using pressed-in wrist pins it is necessary to heat the rod small end and install the pins quickly in a fixture. Most automotive machine shops and Chevrolet dealers are equipped to make this assembly. It is necessary to have a least .001-inch or preferably .0012-inch press fit between wrist pins and rods to insure that pins will not loosen and move during running.

If you are going to floating pins, you may want to buy a service pin with machined flat ends, or grind the ends of production pins to form a larger bearing surface against the pin retainers. Install Spirolox or Tru-arc pin retainers. If Tru-arcs are used, install with square edge of retainer facing away from the

end of the pin towards the cylinder wall. This sharp edge will tend to bite into the piston groove better and resist being pushed out. Make sure there is a few thousandths end play with retainer installed. Run the production Moly-groove-type piston rings for best blowby control and minimum friction.

Oil Pump

Weld pickup tube into body of pump. On lower end of pick-up tube, some sort of flat round pickup shield similar to production should be used to keep from picking up air along with oil.

Oil Pan

Modify as necessary for increased capacity. Run semi-circular or flat Corvette tray baffle and some sort of horizontal baffle attached to the lower

Z-28 Camaro is one car that has earned its stripes! Special hood with a reverse scoop as used on L-88 Vette is extra-cost option.



step of the oil pan to retard oil sloshing on brake stops. Corvette high-performance oil pans have excellent baffling already built in, including a trap door to retard oil slosh under braking. If available, a magnetic drain plug should be installed. Custom baffled deep-sump pans are available for competition from M/P.

Oil Cooler

If desired, an oil cooler can be adapted to the 302 engine using a #3157804 cooler available from Chevrolet Parts and Accessories. Adaptors to go in place of production oil filter and remote oil filters to take-off, filter, cool and return oil to engine are available through high performance and marine parts manufacturers. In all

installations, at least 1/2-inch ID line should be used and the oil filtered just before it is returned to the engine to prevent contamination of engine bearings

Oil Pressure Gauge

Oil pressure gauge line should be minimum of 3/32-inch to get good gauge response and help detect any oil pressure losses quickly.

Heads

Production high-performance heads come equipped with 1.60-inch exhaust valves and 2.02-inch intake valves. Improvements in overall performance can be attained with the following head rework: 1. Increase the circumference of valve seats to the outer edge of the valve face and narrow the seat by

increasing the inner seat diameter with a 35-degree stone or cutter for exhaust and 25-degree cutter for intake, leaving a .030-inch intake seat and .050-inch exhaust seat. 2. Remove the unused portion of the valve seat on the valve itself with a 20-degree cut off the underhead of the valve, narrowing the valve face to match the seat width in the head. 3. Remove all ridges from combustion chambers. 4. Open exhaust ports out to maximum size and streamline the exhaust valve guide boss that protrudes into the ports. DO NOT shorten valve guides. Do the same for intake ports. Use valve spring #3927142 at 1.70-inch installed height for cam #3927140. Use steel head
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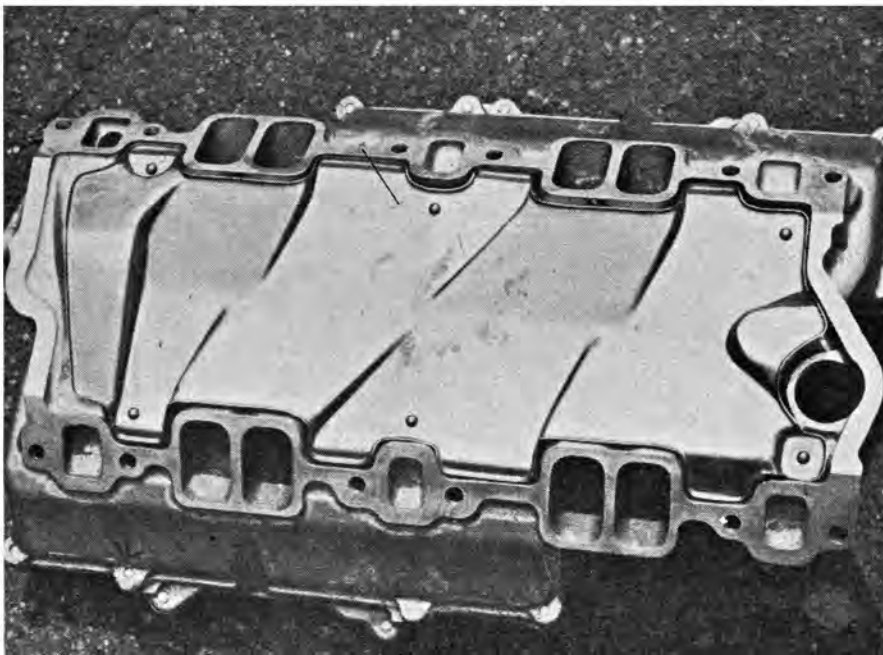


Big-port, big-valve heads were used on hot 365-hp 327 Vette wailer.

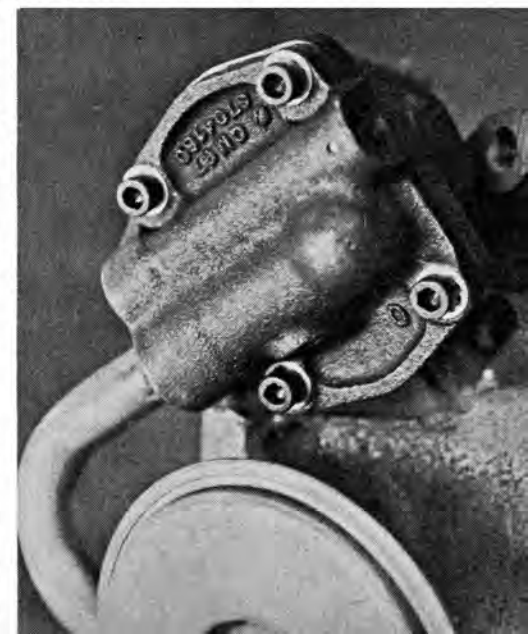


Multi-leaf rear springs should be fitted with traction bars.

Pushrods' eye view of the aluminum dual quad ram manifold designed for Trans-Am comp.



Oil pump should be fitted with brazed-on pickup tube and beefier Allen head bolts.



(Continued from Page 59)

don't want to make wild predictions. They will say that even the early prototypes were considerably stronger and more durable than either the OHC 427 or the tunnel-port wedge 427. And we know these engines will develop between 580 and 620 hp at 7000 rpm on one big four-barrel carb. Ford engineers admit to 650 horses at well over 7000 under the same conditions—on pump gas with an 850 cfm Holley and .600-inch valve lift. Maximum safe revs are above 8000. Where it will go with fuel injection, exotic fuels, supercharges, etc.—who knows? Or even in the street versions: With a 735 cfm Holley, hydro cam, and a decent exhaust system with 2-1/2-inch pipes and dual low-restriction mufflers... we can see 500 horses at 6000!!

Will that do for a starter?

GIANT KILLER continued

Valve Train

Train Production high-performance push rods have a hardened steel inserted tip in one end, and should be installed with this end up. The high-performance rocker arm has a raised letter 'O' forged in the pallet end and a polished pallet. Valve springs should be installed at 1.70-inch height, and should have 110 psi load at installed height for Camshaft #3927140. New rocker arms and balls will burn sooner than than run-in parts. If necessary to change a rocker and ball, *always* install a good used run-in rocker and ball. If no good used ones are available, move an intake rocker and ball over the burned exhaust position and install the new parts on an intake position which runs cooler.

Intake Manifold

The Z-28 intake (#3917608) is an aluminum high rise tuned unit, designed to accept a single Holley four-barrel carburetor. Any size Holley from 500 - 960 cfm can be mounted. Stock is a 780 cfm Model 4053 or 3943. No manifold porting is necessary, but opening up of ports to match manifold gasket and head ports is recommended. Do not remove the center divider from the manifold below the carburetor. Recently released for service is a 2 x 4 barrel intake manifold with two 600 cfm Holley carburetors under part number 3940077 (carburetor conversion unit). These carburetors are jetted satisfactory for competition as released.

Carburetor

Use the #3923289 Z-28 or similar

.780-800 cfm Holley carburetor. This carburetor has 1-11/16" throttle bores. Satisfactory jetting for most running conditions is #72 jets in both primary and secondaries. If richer or leaner mixture is desired, change all jets up or down in size. If necessary, the 600 Holley from earlier model solid-lifter cam 327's can be used. Jetting should be similar to production for 327 model. Connect secondaries to operate mechanically by putting a small bolt in the secondary return quadrant on left side of carburetor if mechanical secondaries are desired. A vacuum-eliminator kit is available. (See parts testing)

The ultimate all-around street-strip carburetion setup is a dyno-jetted Holley 950 cfm three-barrel mounted on an Edelbrock high-riser manifold designed primarily for the three-barrel. The three-barrel should not be run out of the box, as it must be jetted for your particular installation. A vacuum-eliminator (secondary) kit should also be installed to insure positive secondary throttle operation (for strip operation where 5000 rpm and higher starts will be made).

Fuel Pump

If possible, use an electric fuel pump

to boost the engine mechanical fuel pump. The 1963-65 Corvette high performance fuel pump is the most satisfactory Chevrolet product for high performance usage.

The electric fuel pump to use is the M/P *Super-Pumper*, which delivers 75 gallons of fuel per hour and has a built-in pressure regulator. It's actually two electric pumps with a common regulator. It should be mounted at the gas tank for maximum efficiency. *Flywheel and Clutch*

Optionally available from Chevrolet is a 15-pound modular from flywheel kit #3866735 and heavy duty 10.5-inch clutch #3886066 (cover) and #3886059 (clutch disc). This flywheel and clutch are presently released for the 427-cubic-inch L-88 aluminum head engine so are more than adequate for 302 usage.

Because of the high-rev potential of the small-block Chevrolet motor, it's *highly recommended* that an explosion-proof Schiefer Aluminum clutch, pressure plate and disc be installed in place of the stock HD parts. It's also a must to install a good, *NHRA*-approved scattershield such as the Lakewood unit, when going racing.



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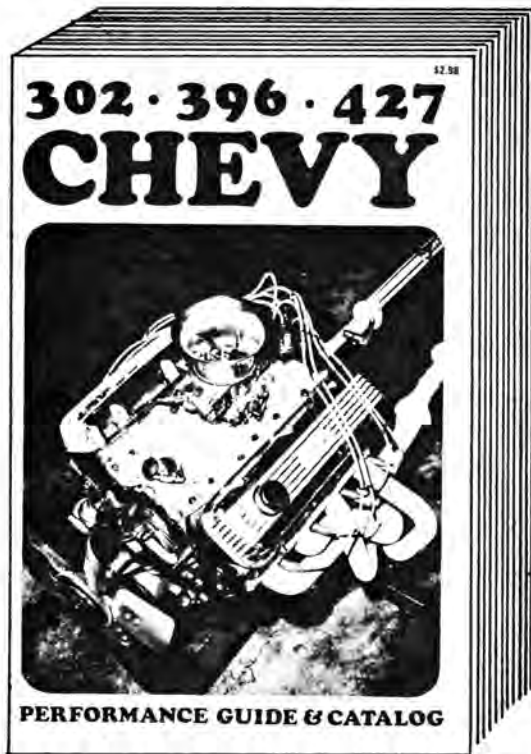
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Distributor

Production Z-28 Distributor is a conventional breaker point model. Optionally available is transistor system distributor #1111267. Also available is Distributor #1111263 which is a ball bearing unit with tach drive included. This distributor is for gear drive camshaft 427's and requires that you change the distributor drive gear to a chain drive model. Do not hook up vacuum advance. Run 38-42 degree maximum advance.

The maximum-performance ignition setup, for street or strip, is the custom-calibrated M/P-Mallory dual-point, full-centrifugal advance distributor, with matching MK.II coil and burn-proof Ramcharger stainless steel core wiring. The M/P distributors are special units manufactured from Motion Performance by Mallory and set up for each particular installation by trained technicians. The wiring is burn and leak proof and features Rajah plug clips for positive spark control. Special silicon-covered burn-proof matching plug boots should also be used if the engine is equipped with tubular steel headers. Special Capacitive Discharge ignition systems are available on special order for this engine.

Exhaust System

A tuned open exhaust system is mandatory maximum torque and horsepower from these engines. Correct dimensions for such a system are 1-3/4-inch OD by 34-inch long head pipes collected in a group into 3-1/4-inch to 3-1/2-inch collector tailpipes. Large 3-1/2-inch tailpipe is preferred for any installations requiring more than 36 inches of tailpipe. Several header systems designed to these dimensions are currently being marketed by speed shops and high performance parts manufacturers. Headers recommended by M/P are those manufactured by Hooker. *performance specifications*

Following are several recommended operating specifications and limits that should insure long and satisfactory service from an engine built to the foregoing instructions.

Oil - 30 to 50 weight aircraft or other ashless high-performance oil (DA, Valvoline, etc.). An oil with ashless additives is specified to prevent pre-ignition and burnt pistons.

Fuel - The best super premium available. Examples are 260 Sunoco, 115-130 octane aviation gas, or Pure racing gasoline.

Spark plugs - AC41 or C42-1 for
(Continued on Page 68)

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(Continued from Page 64)

track racing; 43 for drag racing. Auto-lite-AT2, A22, A23, or A903 for track racing; AT4, A42 for drag racing. Champion - J61Y, J60R, J86Y, or UJ60P for track racing; J63Y, J6J, or UJ64P for drag racing.

Spark Advance - 14 degree initial advance giving 38 to 40 degrees at high rpm.

Valve Lash - .030 Intake, .030 Exhaust for production Cam #3849346. .022 Intake, .024 Exhaust for service Cam #3927140.

Maximum Speed for Optional Cam - 6800 - 7200 rpm, for track racing, 7800 rpm for drag racing.

Maximum Oil Temp - 300 degree in oil pan.

Minimum Fuel Pressure - 4 - 5 psi at high engine speeds.

In operating conditions where fresh air is ducted to the carburetor (fresh air hoods, plenum air cleaners, etc.), it is necessary that an air cleaner element or low restriction element be used to diffuse the air entering the carburetor. If no diffuser is used, the engine mixture distribution will be upset, causing poor power and misfiring at high engine speeds.

THE SNAKE continued

But, for '69 Ford has its new unit ready. It's called the Traction-Lok differential and it's available with performance ratios of 3.50, 3.91 and 4.30 from the factory. Lower gears (higher numerically) are available for do-it-yourself installations. This differential locks tighter in proportion to the driving torque applied than the old unit. A decrease in fixed loads, together with an improved clutch and special gear angles, provide a wide range of performance under all conditions. It's ideal for street or strip use, but still nowhere as efficient as the gear-type locker for sophisticated drag machinery.

Ford also has a new clutch that's really perfect for high horsepower street and strip applications. It's a dual-disc affair which was originally designed for trucks and later proven under enduro conditions in the *Mach 1* Mustangs driven by Mickey Thompson to 350 records at Bonneville. The original dual-disc clutch discs were too heavy, causing the synchros to work themselves to death in the transmissions. They had a tremendous amount of hard shifting problems when the units were first released for truck service. However, the improved version used in the *Mach 1* Salt record-breakers features lightweight

discs and floater plates and have no ill effects of shifting. The improved unit will be available to the public early in 1969.

There's also a new street/strip suspension available with 428 Cobra Jet cars fitted with four-speed transmissions. The same suspension is available on automatic transmission cars, except that the shocks are mounted conventionally instead of staggered. The staggered shock arrangement is designed to control spring wind up and wheel hop caused by the axle twisting under acceleration conditions. The left shock is relocated to the rear of the axle, while the right shock remains ahead of the axle. This setup partially restrains and damps out the twisting motion of the rear during full throttle starts. This provides the owner with an excellent starting point only, as the car still needs more performance oriented shocks, traction bars and possibly adjustable air bags for proper chassis preloading for strip tractions. Chevrolet went the staggered shock route last year with the Camaro, but the car still needed traction bars. To aid the suspension and traction aids there's an LPO (Limited Production Option) which specifies that the battery be mounted in the trunk over the right rear wheel.

Ford has obviously gotten the message and you can expect bigger and better things from Dearborn in mid-'69 and '70. They finally have come to realize that the street is where the action and the sales are, not at Indy or LeMans.

MINI COBRA continued

of chatter or hop. Some of the give in the rear suspension comes from the tires—a set of 9:50x14's—have seven inch tread width. The attempts at dropping tire pressures to 6 pounds for very slippery tracks were unsuccessful, as the slicks proved squirrely and lost too much at the top end. With eight pounds pressure, they worked well. "Traction is just not one of our problems," says Bob.

Win, lose or draw there is always that long tow home sometimes with a broken rear and that's when you see guys working into the night changing axle housings at the last minute. Bob comes prepared with a special center section that is set up for towing. He has no gears, just an aluminum coverplate instead of a flange for the rear "U" joint. After the last run, this "towing third member" is installed. It cuts down

(Continued on Page 70)

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