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direct connection

RACE BULLETIN
TUNE-UP TIP

361-383-400
413-426W-440
B-RB ENGINE RACING MANUAL

CHRYSLER CORPORATION

B AND RB ENGINE

I. INTRODUCTION

This bulletin has been prepared as a guide for the customer who wants a higher level of performance and reliability from his car's "B" or "RB" engine. Included are performance modifications and tuning tips covering both the "B" and "RB" versions of the Mopar big block wedge engine. The parts and procedures outlined in this Bulletin represent those which Engineering and the Direct Connection have evaluated as part of its continuing performance development program. The parts developed as a part of this program are available to the racer through the Direct Connection dealers and wholesale distributor outlets.

The "B" series wedge engine was introduced in 1958 in 350 and 361 cubic inch versions. Being primarily a passenger car engine, it took several years for the new engine to establish a reputation, but by late 1963 it was one of the highest performance engines available. In 1964 the performance spotlight switched to the 426 Hemi. The "B" and "RB" engines made a great comeback in 1969, 1970 and 1971 to become one of the most popular high performance engines ever produced.

The performance story of the "B" engine begins with the introduction of the long ram, 2-4-barrel setup in 1960. Two years later in 1962 the biggest year in the performance history of the "B" engine was reached. This marked the introduction of the 413 Max Wedge, 2-4- barrel, cross-ram engine with 420 hp (highest up to that time.) The 426 engine was also introduced in the 1962 Chrysler, and the 383 was available with the famous 300J heads and 2- 4-barrel, in-line carb setup for 343 hp rating, which is the highest performance 383 ever produced. The Max Wedge was continued in 1963 and 1964 as a 426 in the Stage II and Stage III versions. These Max Wedge engines were very unique with special blocks, rods, cranks, pistons, heads, valves, valve gear, intake manifolds, carbs and exhaust manifolds.

The 440 engine was introduced in 1966 and the high performance version was introduced in the 1967 GTX and R/T models. Then in 1968 the 383 Road Runner and Super Bee models were introduced to start the biggest performance surge since the early 1960's. In 1969 the first 440-6 Bbl. engine package was produced with special rods, crank, timing chain, camshaft, valve springs and intake system. This package was continued in 1970 and 1971.

In 1971, 440-6 Bbl. along with the Hemi were the last truly high performance cars produced. One of the greatest moments in the "B" engine's performance history was its return to Grand National racing. On July 4, 1971, four cars with 426 cubic inch versions of the 440 with ported 440 heads were entered in the Daytona GN race, and they finished 1-2-3-4. Performance *AND* reliability have always been trademarks of the "B" engine family.

The 400 engine was introduced in 1972 in standard and high performance versions. The 400 is a large (4.34) bore version of the 383. The performance aspects of the "B" and "RB" engines faded from 1972 on until the last B-RB engine was produced in August, 1978.

Over 3 million 383 engines were produced through 1971, and over 3/4 of a million 440 engines have been produced which makes parts readily available. The 361-383-400 series is referred to as the "B" engine and can be identified by the cubic inches stamped on the right side of the block deck adjacent to the distributor. The 413-426W-440 series is the "RB" engine and can be identified by the engine size stamped on a pad at the left front of the engine adjacent to the front tappet rail. All "B" and "RB" engine distributors are located at the right front of the engine. Parts replacement information such as undersize crankshaft is located next to the engine size.

The 361, 383 and 400 c. i. versions share the same 3.38" stroke, while the remaining engines share a 3.75" stroke.

"B" series wedge engines have virtually complete parts interchangeability with few exceptions. The most popular "B" engines for performance include:

	Bore		Stroke	Cu. In.
Lo Block	4.12	x	3.38	361
	4.25	x	3.83	383
	4.34	x	3.38	400
Hi Block	4.18	x	3.75	413
	4.25	x	3.75	426
	4.32	x	3.75	440

Other earlier (1958-1962) "B" engines include the Lo Block, 4.06 x 3.38 cu. in. and the Hi Block 4.03 x 3.75, 383 cu. in.

Because of the almost complete parts interchangeability between the Lo Block and Hi Block "B" engines, the two groups will be covered together.

This bulletin will concentrate upon the engine only. Other aspects of performance such as transmissions, axles, etc. are covered in another book. Please refer to the last page of this bulletin for information on where to write.

II.
B-RB PARTS AND PIECES

We will now discuss the "B" engine family piece-by-piece as to differences, interchangeability and what special parts are available. Later, we will assemble the pieces into packages to improve your engine's performance and durability.

A. Bellhousing

The bolt pattern at the back of the block is the same on all "B" and "RB" engines. It is also the same as that used on the 426 Hemi. All the B-RB engines from 1970 to 1976 used the same bellhousing, PN 2892511, which is designed for the 11" scalloped or 10½" standard clutches. An 11" standard clutch will not fit in this bellhousing.

NOTE: Manual transmission option was dropped on B-RB engines in 1976 in passenger cars.

There are two drag race Lakewood Safety bellhousings available for the B-RB engines — the 1-piece, PN P3412081 and the 2-piece, PN P3690444. Either of these Lakewood housings will accept both the 10½" and 11" scalloped clutches. The 11" scalloped clutch uses the same pressure plate-to-flywheel bolt pattern as the 10½" clutch.

Clutches are covered in Bulletin #7 and the bellhousing bolt pattern is shown in Bulletin #28. Refer to last page of this bulletin for more information.

B. Water Pump

All "B" engine and Hemi water pumps are interchangeable. An aluminum water pump housing, PN P2536086 is available which will fit all B-RB engines. All the earlier (pre-1972) B-RB engines used a different water pump, PN 2808681 on engines with air conditioning. The standard non-A-C water pump was PN 2808680. In 1972-1978 all B-RB engines used a common water pump, PN 3683834 which is the A-C unit. The air conditioning water pumps require less horsepower to drive than non-A-C water pumps.

NOTE: The alternator bracket attaching hole is not in the same place on the aluminum water pump housing as it is on the 1968-1978 housings. To correct for this, the earlier alternator bracket, PN 2658990 or PN P2206445 should be used with the aluminum housing.

C. Ignition

All the "B" engine distributors are interchangeable as are all the "RB" engine distributors. Also, the "RB" distributors, including the Hemi, can be installed in the "B" engine by using an aluminum adapter, PN P3690275. The distributors for the electronic ignition with vacuum advance are PN P3690431 for the "B" engine and PN P3690432 for the "RB" engine. The electronic ignition distributor with mechanical advance only and with mechanical tach drive for the "RB"engine is PN P3690201. This same distributor can be used in the "B" engine with the adapter. Refer to a later section on "Ignition Systems" for information on converting a point-type system to an electronic ignition system. Also refer to Bulletin #25.

All the B-RB engines use the same ignition wires. High performance radio supression wires, PN P4286525 are available. Race ignition wires with a solid metal core are also available under PN P4120716. Both sets come with a crimping tool.

D. Cylinder Block

The "B" series engine family has two basic blocks, one for the Lo Block and one for the Hi Block or raised block. However, each different bore size requires a different block casting. Some of the more current blocks are 440, PN P4006628; 426 wedge, PN 2659974; 400, PN P4006523; and the 383, PN 2468403. The 1963-1964 max. wedge block, PN 2406728 had valve clearance notches machined in the block at the top of the cylinder bores. The 383, 400 and 426 blocks are no longer available. The 426 Hemi block has a different head bolt pattern and different engine mounting lugs and will therefore not interchange with a "B" engine wedge block.

The 1976-1977-1978 blocks for the 400 and 440 are a thinwall casting design. As such they shouldn't be overbored more than .020". Therefore the pre-1976 blocks are better for racing purposes.

In building B-RB engines up from a bare block, the D.C. hardware package, P4007943 is very useful. It includes all the pipe plugs, dowel pins, core plugs and other small parts required.

All the B-RB engine blocks have a cylinder-to-cylinder bore spacing of 4.80". The "B" engine block with caps weighs 225 pounds. The "B" engine has a crankshaft centerline to the top of the block dimension of 9.98" while the same dimension for the "RB" block is 10.725 inches.

E. Cylinder Heads

All "B" and "RB" engine cylinder heads are interchangeable. The only problem arises in trying to

use Stage I, II or III heads (413-426 max. wedge) on a "B" engine (383-400) because there is no intake manifold available for this combination.

There have been many "B" and "RB" engine heads since 1958. The early "B" engine (up to 1961) used a head with 1.95" intake valves and 1.60" exhaust valves. "B" engine heads (up to 1963) had only four valve cover attaching bolts and used aluminum rocker shaft attaching brackets. The standard 1962 head had a 2.08" intake, but retained the 1.60" exhaust valve. Several early "B" engine high performance heads, like the 300J head, used a 2.08" intake valve and a 1.74" exhaust valve. In 1963 and 1964 the six valve cover attaching bolts and cast-in rocker stands were introduced and are still in use.

The max. wedge heads, which were used on the 1962, 413 and 1963-1964, 426, can be easily identified because they have no heat cross-over passage. These heads had very large ports, (See Figure 2-1 and a larger exhaust valve (1.88"). These heads are no longer available. Use P4120549 to save wearing out good Stage I, II, III heads. This new D.C. Stage IV head will be discussed in a later section.

The standard head used on the "B" engine from 1964 to 1966 had 1.60" exhaust valves and can be identified by a casting number of 2406516. In 1967 the 440 H.P. head, casting no. 2780915 was introduced which uses a 1.74" exhaust valve. The 1967, 440 H.P. heads had superseded the old 300J heads and can be purchased under Part No. 2806762. In 1968-1971, a larger combustion chamber version of the 1967, 440 H.P. was used. This head can be identified by casting no. 2843906. In 1972 (and some late 1971's) the new emission head with the flatter intake port was introduced on all "B" engines and has a casting number of 3462345. These heads have superseded the 1968-1971 "B" engine head and can be purchased under PN 3462344. The "B" engine head introduced in mid-1973 is similar to the 1972 head except that it has extra cooling passages next to the spark plug hole which helps durability on a "Motor Home" engine. The 1974-1975-1976-1977-1978 "B" engine head castings are basically only new emission heads similar to the 1971-1973 heads with a few minor changes such as hardened valve seats for use with unleaded gas.

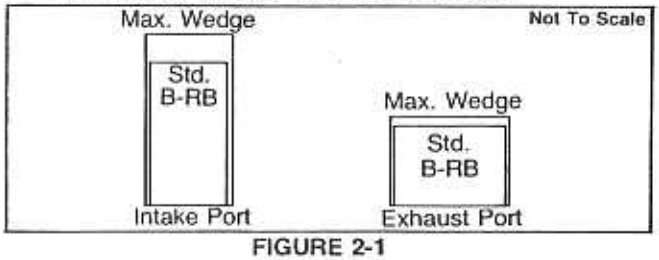


FIGURE 2-1

"B" ENGINE CYLINDER HEADS

	Casting Number	Service Number
'60-62 361-383-413	2206324	2128589
'62 413 Max. Wedge	2402286	2402358
'64-67 361-383	2406516	2406732
'64 426 Max. Wedge	2406518	2406736
'63 361-383-413	2463200	2448752
'63 426 Max. Wedge	2463209	2406754
'67 440 H.P.	2780915	2806762
'68-70 383-440	2843906	2843904
'71-72 383-400-440	3462346	3462344
'73 400-440	3462346	3671640
'73 400-440 "Motor Home"	3751213	3751218
'74 400-440	3769902	3769910
'75 400-440	3769975	3769954
'76-'78 400-440	4006452	3769954

The B-RB cylinder head is attached using 7/16" head bolts. D.C. package, P4120472 includes a complete set of head bolts. The B-RB head bolts are not used in production with head bolt washers. If the head and/or block are milled .060 or more (total), then hardened head bolt washers, P4120457 should be used to keep the bolts from bottoming in the tapped holes in the block.

F. Valve Covers

All the "B" and "RB" engine valve covers are interchangeable except for the location and number of holes in the top of the cover for the PCV valve, oil fill, etc. There are chrome dress-up valve covers available, right and left set, P4120609.

NOTE: The current 1964-1978 six-hole valve covers can be used on the four-bolt heads if a gasket is chosen that is wide in the corners. A thick cork gasket is the best bet. The four attaching bolts in the valve cover will never seal as well as the six attaching bolts.

All the B-RB engines can use the D.C. valve cover dress-up package, P4120272 which consists of chrome-plated screw and washer assemblies, chrome-plated oil filler cap and rubber grommets. Also available is a chrome breather cap, P4120446.

G. Crankshaft

The Lo Block and Hi Block "B" engines not only have different strokes, but also have different main journal diameters. The Lo Block engine has the smaller main journal diameter (2.625" vs. 2.750" for the "RB".). Both cranks use the same rod journal diameter of 2.38".

Late in 1971, cast cranks were introduced in the 383-2 Bbl. engine and have been used in all 1972-1978 400's except some 1972-1974 400-4 Bbls. Cast cranks use a specially balanced vibration damper and a specially balanced torque converter or flywheel. They have the same main and rod journal diameters as the forged cranks. The 383 forged crank is PN 2268114 while the 383 and 400-2 Bbl. cast crank is PN 3462922. The 400-4 Bbl. uses a stronger cast crank, PN 3672000 than the 400-2 Bbl. The 440 (1967-1973) uses a forged crank of which there are several versions. The standard early model (1967-1970) 440-4 Bbl. crank was PN 2536983. The 440-6 Bbl. (1970-1971) used a heavy duty crank, PN 3512036 with special external balancing. The special external balance was required because of the 440-6 Bbl's heavy connecting rods. The 1972 and 1973, 440-4 Bbl. high performance engine uses a different crank, PN 3671283. The standard 440 (1973) uses PN 3671242 crank. Both of these cranks are forged and differ from the 1971, 440 crank primarily in the balance weights that are required because of the lighter pistons used in the 1972-1973 engines.

The cast crank was introduced in the 440 in 1974. This crank, PN 3751889 also requires external balancing of the vibration damper and the torque converter assembly. Refer to Figure 2-2.

All the cast cranks mentioned above, along with the 440 engines in 1970-1972 that use the 440-6 Bbl., heavy duty connecting rods, are externally balanced. This means that part of the engine's balance is in the flywheel or torque converter. (The other part is in the vibration damper). For externally balanced flywheels, refer to Bulletin #7. Torque converters can be balanced for the external balanced engines by using balance weight and template package, P4120241. All engines are covered in one package. Also refer to Bulletin #19.

The "RB" engine will accept the Hemi cranks. However, it is suggested that if this is done, the appropriate Hemi connecting rod also be used. The Hemi cranks are 8-bolt, while all "B" and "RB" engine cranks, both forged and cast, use 6 bolts.

H. Bearings

All raised block (RB) engines have the same main bearing diameters as the 426 Hemi. Therefore, the Hemi main bearings can be used in RB engines. The Hemi main bearing sets are as follows: Aluminum, PN P2836116; Tri-Metal F-77, PN P2836118; and Babbit, PN P3412037. Because of the main bearing diameter, Hemi bearings won't work in a standard "B" engine (Lo Block) such as a 383.

Production main bearings for the "B" engine family are available in several undersizes such as .001, .002, .003, .010 and .012 as well as standard size. These are the standard bearings, not the Hemi ones. The production "B" main bearings changed in 1974. The locating tap was moved making the early and late main bearings not interchangeable.

The Hemi main bearings are fully grooved. The "B" engine production main bearings have only one shell grooved. Therefore, to have fully grooved bearings in the "B" engine, two sets of production bearings should be used and only the grooved shells installed.

A simpler solution is to use the D.C. bearing sets. They are fully grooved and feature extra clearance and aluminum material.

"B" engine main bearings sets:

Standard Size 1973 and earlier	P4120066
Standard size 1974 and later	P4120067

J. Vibration Damper

The early (up to 1971) "B" and "RB" engines used the same vibration damper, PN 2658457. The 1970-1971, 440-6 Bbl. and the 1971 high performance 440 used a specially balanced damper, PN 3512017. This is required because of the heavy duty connecting rods and should not be installed on an engine without the H.D. rods.

The 1971, 383-2 Bbl. which has a cast crank, requires a specially balanced damper, PN 3577180. See Figure 2. The 1972-1973 "B" and "RB" engines have new dampers because of a revised pulley attaching bolt pattern. These new dampers are: 1972-1973, 400 forged crank, PN 3614371; 1972-1973 400 cast crank, PN 3614374; 1972-1973, 440 standard, PN 3614371; 1972-1973 440 H.P., PN 3614372. The 1974 vibration damper for use with the 440 cast crankshaft is PN 3577785. See Figure 2-2.

SPECIAL NOTE: Do not use the cast crank vibration dampers with forged crankshafts.

K. Camshaft

Most of the 1966-1967, 383's, all 383-2 Bbl., 400-2 Bbl. and standard 400-4 Bbl. and 440-4 Bbl. engines have used a 256° duration cam. The 1968-1976, 383 and 400-4 Bbl. H.P. and 1967-1976, 440 H.P. engines have used a high performance camshaft, PN 3512907, which has 276° duration. All "B" and "RB" cams, except for the 440-6 Bbl., have a single bolt attaching the cam sprocket to the camshaft. The 440-6 Bbl. used special low-taper, 276° duration camshafts, 1970, PN 3512033; 1971, PN 3512903; which used a 3-bolt cam sprocket similar to the Hemi and special hydraulic lifters.

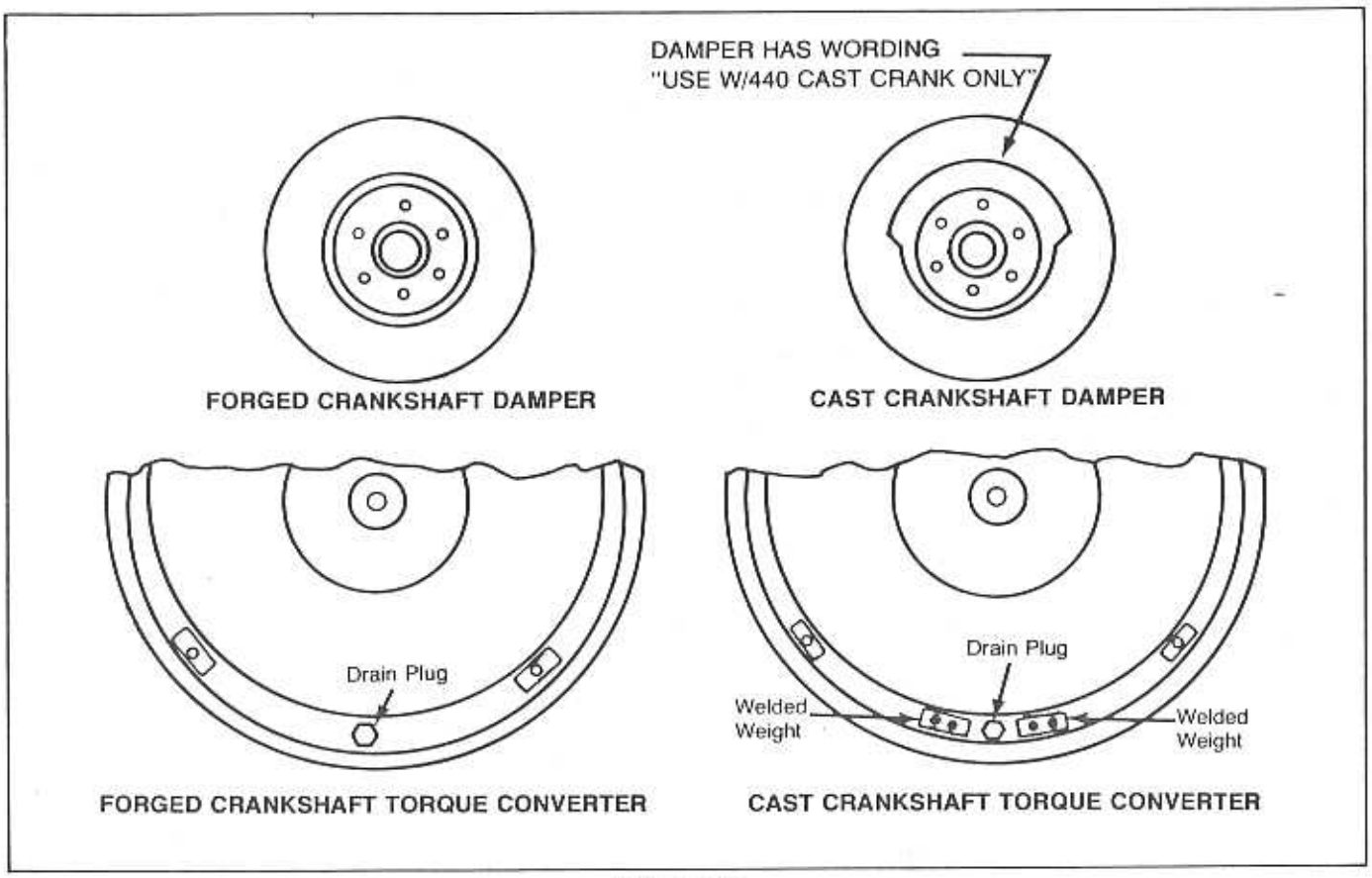


FIGURE 2-2

The cam usage in the last years (1976-1978) is more confusing. The high performance cam, PN 4071002 is the same as the earlier H.P. profile, PN 3512907. Production installation of this cam is too complicated to cover. However, there are only two designs: The H.P. already mentioned and the standard profile used with the 2-Bbls in the earlier years.

Also available for the B-RB engines is the "Purple Shaft" Street Hemi grind, PN P3690214, which has a 284° duration. All these cams are hydraulic. All B and RB cams are interchangeable if the proper lifters and cam sprocket are used. Camshafts for a Hemi engine will *fit* in the "B" engine, but *will not* operate the B-RB engines.

The D.C. high performance cams will be covered in a later section. Hydraulic tappets for B-RB cams are P4006767.

All "B" and "RB" engines use the same camshaft bearings. The D.C. babbit cam bearing set is PN P4120261.

L. Timing Chain and Sprockets

All "B" and "RB" engines, except for the 440-6 Bbl. use the same timing chain and sprocket. The 440-6 Bbl. uses the 426 Hemi roller timing chain and sprockets. The cam sprocket is a 3-bolt design. A single bolt cam sprocket is available for the roller timing chain. The part numbers for the "B" and "RB" (and Hemi) engine roller timing chain pieces are: One-bolt roller cam sprocket, PN P3690277; three-bolt roller cam sprocket, PN P3690278; roller timing chain, PN P3690279; and roller crank sprocket, PN P3690280. These parts are completely interchangeable on any "B" engine providing the cam sprocket bolt pattern is chosen to match the engine's camshaft. The above chain and sprockets are included in sets in the following packages:

3-bolt mount	P4120263
1-bolt mount	P4120264

The 440-6 Bbl. cam sprocket is attached by three bolts, PN 2120930, which should be loctited when they are installed. The single cam sprocket bolt to attach the single-bolt sprocket, PN 9417471 should be used with a special washer, PN 6023053. All cam sprocket bolts should be loctited into place.

M. Connecting Rods

There are two connecting rod lengths — 6.358" for all "B" engines (383-400) and 6.768" for all "RB" engines, 413-440. All "B" and "RB" engines use a

pressed piston pin in the rod. The 383-400 rod is PN 2406766. The standard 440 rod is PN 2406770. The 1970-1971, 440-6 Bbl. used a heavy duty rod, PN 2951906 which is also used in the 1971-1973, 440 high performance engine. See Figure 2-3. The 1963-1964, 426 max. wedge used a special rod, PN 2406885.

For high performance applications, there are two magna-fluxed double shot peened and mildly polished rods with the high-strength bolts and nuts. The "B" engine uses PN P3690644 (cancelled) while the "RB" engine uses PN P3690649.

This "RB" rod (P3690649) is a standard forging shape but uses better material referred to as 8640 forged steel. This special material gives the added strength necessary for high output usage without the added weight which cuts down on the engine's performance. The rods also have the high strength bolts and nuts. These are the best rods to use for racing applications such as Super Stock, Formula Stock or bracket racing. Refer to a later section for more information on rods.

N. Rod Bolts and Nuts

All the production "B" and "RB" engine's connecting rods use a 3/8 bolt and nut. A hi-strength steel bolt, PN P3614522 and hi-strength steel nut, PN P3690632 are available which fit in all the production rods. Only the two special magna-fluxed shot-peened rods mentioned above have these hi-strength bolts as standard. For racing purposes the connecting rod bolt is the weakest link in the bottom end, so the hi-strength steel bolts and nuts are highly recommended. The above hi-strength steel bolts and nuts can be obtained in sets, P4120068.

O. Rod Bearings

All "B" and "RB" engines can use the same rod bearings. Hemi rod bearings also fit. The Hemi (standard size) rod bearings are F-77 Tri-Metal, PN P2525484; Aluminum, PN P2836117; and Babbit, PN P2836184. Undersize rod bearings are also available in .001, .002, .010, .012 undersizes, but these are the production type bearings, not the Hemi bearings.

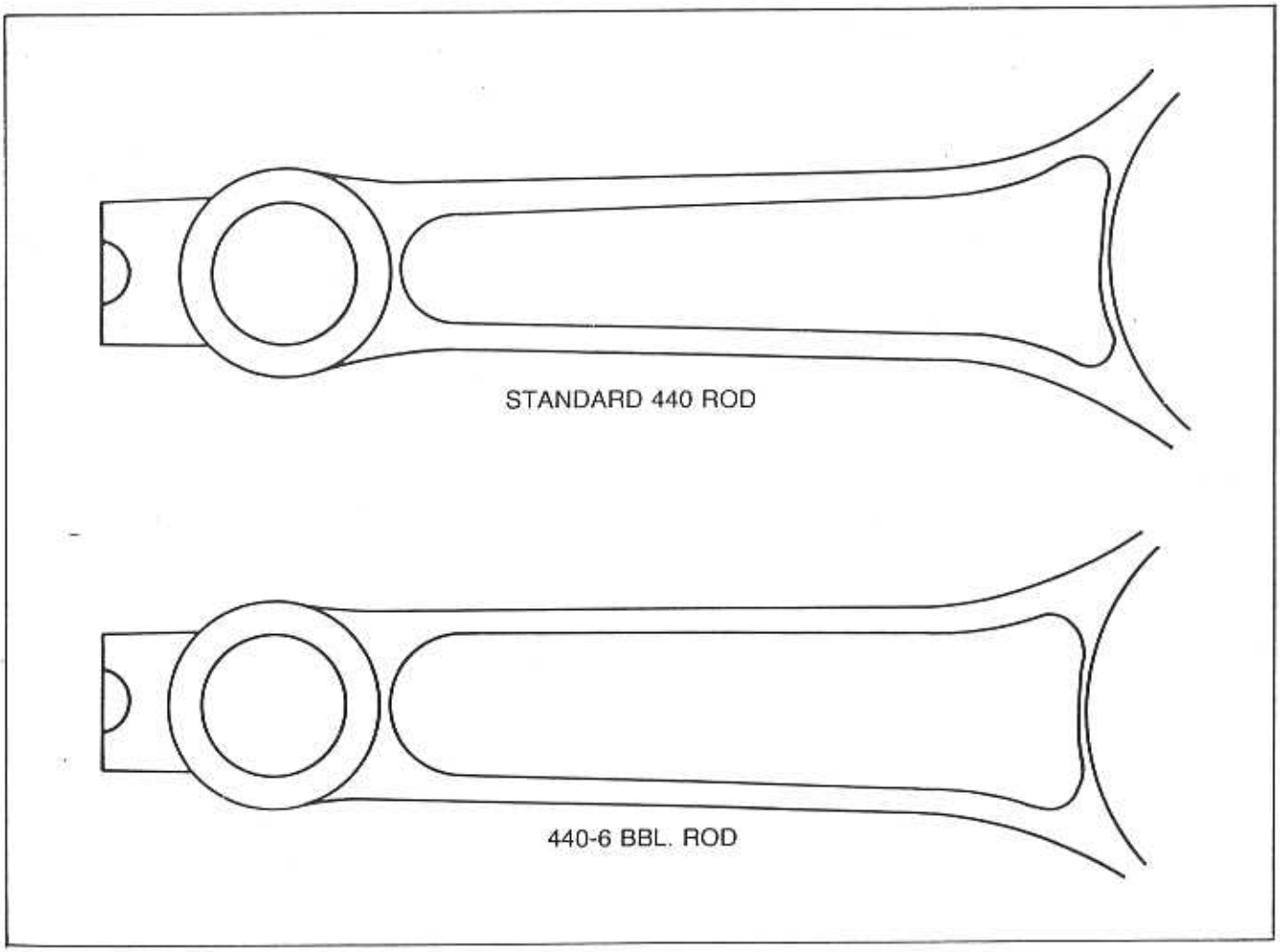


FIGURE 2-3

P. Piston and Pin

The actual piston used in any engine is determined by its cylinder bore size. Therefore, piston interchangeability is very limited. The 383 and 440 in 1968 used a piston that was .034" higher in the bore than the 1967's. These pistons installed in a 1967 engine would raise its compression ratio. All 383 engines used a 770 gram piston. The 400 uses a 768.5 gram piston. The early (1967-1971) 440's used an 857.5 gram piston while the 440-6 Bbl. used a 864 gram piston with four valve notches.

All "B" and "RB" engines use a 1.09" diameter piston pin which is pressed into the rod.

If higher compression ratios than standard are desired to increase the engine's efficiency and performance, 11.5 to 1 high compression ratio forged pistons are available for the 383, 400, and 440 engines in the standard bore size and .030 and .060 oversizes. These pistons feature a domed top design rather than the flat top design used on the standard pistons. Refer to Figure 2-4. Special .005 oversize rings are used with these forged pistons so that the ring end gap can be custom fit to tighter clearances.

These high compression pistons are advertised as an 11.5 to 1 ratio, but if the block or head or both are milled (decked) then higher ratios such as 12 or 12.5 to 1 are quite easily obtained.

383 Engine with 11.5:1 Compression Ratio:

Standard Size	P3690827
.030 Oversize	P3690828
.060 Oversize	P3690829

400 Engine with 11.5:1 Compression Ratio:

Standard Size	P3690830
.030 Oversize	P3690831
.060 Oversize	P3690832

400 Engine with 11.5:1 Compression Ratio:

Standard Size	P3690833
.030 Oversize	P3690834
.060 Oversize	P3690835

NOTE: Some of the above PN's have been cancelled. Check latest D.C. catalog for availability.

Q. Valves and Valve Gear

The "B" engine valve sizes have not changed since 1968. The 440-6 Bbl. used chromed stem, heavy duty valves, PN 3418475 intake and PN 3418479 exhaust. In 1971 a double lock groove intake valve, instead of a single groove, was introduced and used in most heavy duty applications. The 440-6 Bbl. double lock groove intake valve is PN 3549983. The single and double lock groove valves are interchangeable as long as the correct valve locks are used. The 1962-1964, 426 max. wedge heads used valves, PN 2402318 intake and PN 2402322 exhaust (1.88 diameter). All the newer "B" engines use the same valve spring retainer, PN 2402045. There are two different length hydraulic lifter pushrods. The Lo Block, "B" engine uses PN 2899594. The raised block "RB" engine uses PN 2899595.

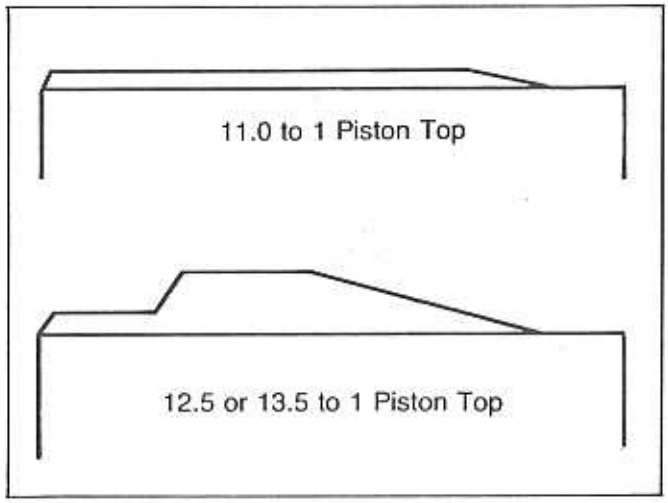


FIGURE 2-4

DOMED B-RB PISTONS

Heavy duty valve springs were used on the 1969-1971, 440-6 Bbl., PN 3418491. The 440-6 Bbl. hydraulic rocker arms are no longer available. They have been replaced by PN P3690712 right and P3690713 left, which are heavy duty and are thicker in the socket area where the pushrod seats. See figure 2-5.

The standard heavy duty valve springs used on the 1968 and newer, high performance 383's, 400's and 1967 and newer 440's are PN 2658204.

The best heavy duty valve springs to use with hydraulic cams of up to .520" lift are the street hemi type, PN P3690933.

For high performance B-RB applications, the best intake valve available is zyglow inspected, 2.08" diameter, PN P3690708. The best exhaust valve to use is zyglow inspected PN P3690709 with a 1.74" diameter. The 1.74" exhaust valve can be installed in the pre-1968 heads which had the 1.60" exhaust valves by enlarging the valve seat.

For oversize valves for the B-RB engines, the Direct Connection carries a 2.14" intake valve, P4007942 and a 1.81" exhaust valve, P4120579. Both valves are single groove designs and require the valve seat in the head to be enlarged.

Mechanical valve gear components for the Lo Block and raised block versions of these engines include the following:

Heavy duty tubular pushrods with hardened inserts; Adjustable malleable cast iron rocker arms.

Use of this equipment will increase the engine power output and allow it to run at higher rpm by eliminating hydraulic tappet pump-up. These valve gear combinations must be used in conjunction with a suitable hi-performance camshaft and mechanical tappets. See figure 2-6.

361, 383 and 400 c.i.d. low block engines:

8 — 2463242 Rocker Arms (Right)
8 — 2463243 Rocker Arms (Left)
16 — 2402035 Pushrods (Heavy Duty)

413, 426 and 440 c.i.d. raised block engines:

8 — 2463242 Rocker Arms (Right)
8 — 2463243 Rocker Arms (Left)
16 — 2402326 Pushrods (Heavy Duty)

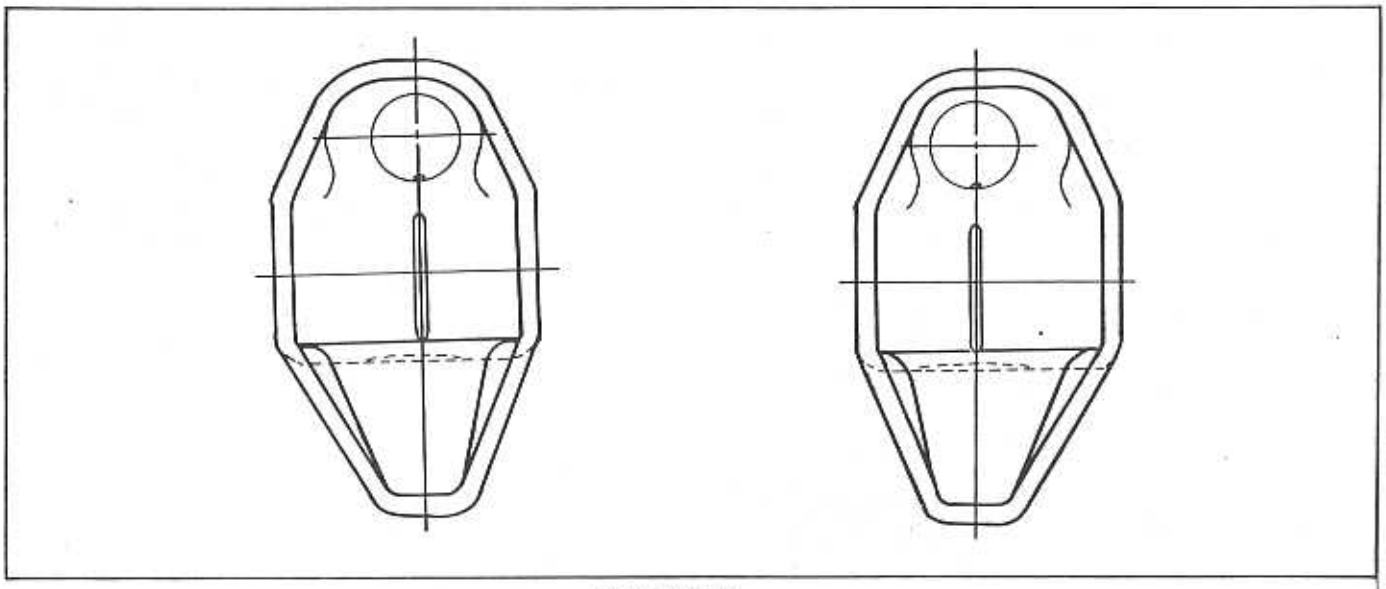


FIGURE 2-5

HYDRAULIC ROCKER

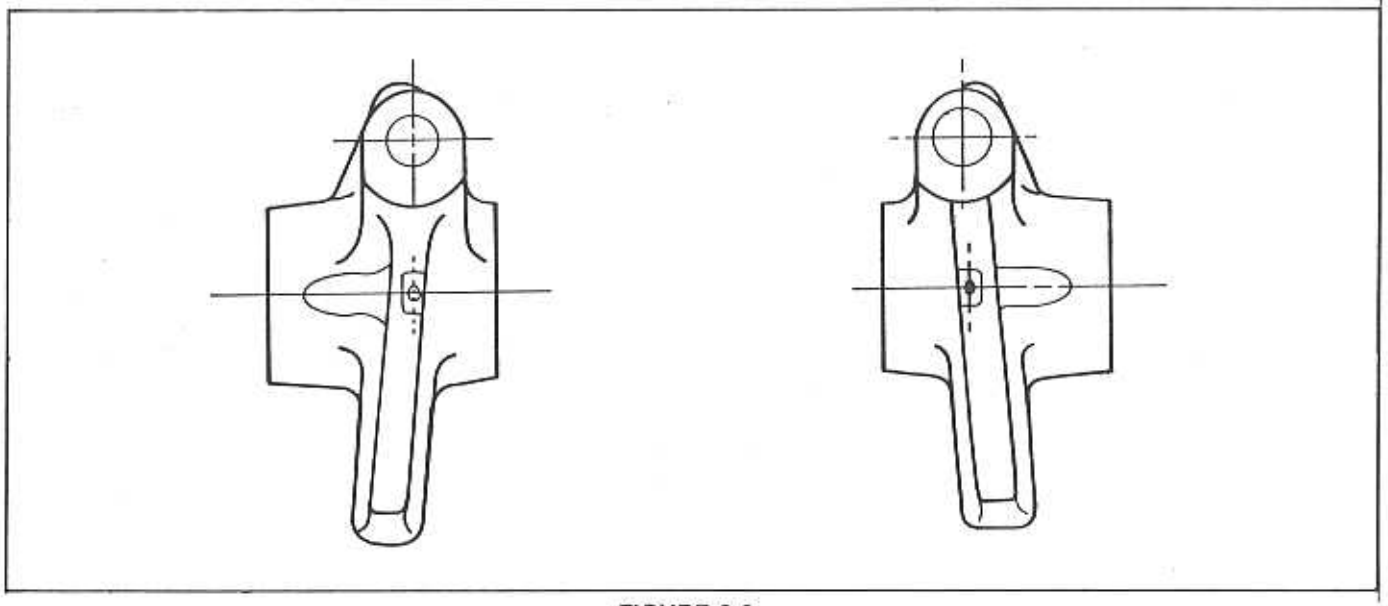


FIGURE 2-6

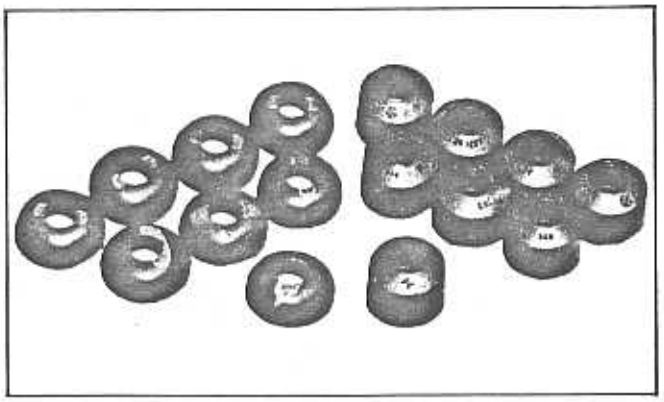
MECHANICAL ROCKER (B)

The original 1964 numbers listed above are becoming hard to obtain. D.C. carries the complete mechanical rocker arm package PN P4120974. Refer to later section on valve gear or the latest D.C. catalog.

Also available for racing use are hardened valve stem locks or keepers in single, double and triple groove, and hardened 3/8 stem lash caps. Further details are given in the racing sections.

The rocker arm adjusting screw and nut for the mechanical rocker arms are carried in one package, P4120636. These can be used with the above adjustable rocker arms.

The best valve seals for the B-RB are the special heavy-duty Viton seals, P4120492. They are high temperature resistant, for use on 3/8 stem valves, and can only be used with single valve springs such as P3690933. If dual springs are used, then the PC seals, P3690963 must be used.



VITON VALVE SEALS

The viton valve seals (P4120492) are sold as a package of sixteen — 8 intake and 8 exhaust. They are not the same. The short one goes on the exhaust valve.

Racing valve gear parts such as spring spacers, hardened keepers, retainers, lash caps, rocker arm spacers and roller tappets will be covered in a later section.

R. Flex Plate and Flywheel

All "B" and "RB" engines with automatic and manual transmissions have a 6-bolt crank flange, but the pieces from the cast crankshafts are not interchangeable with those from a forged crankshaft. These two groups will be discussed separately. The 426 Hemi flywheels and flex plates won't fit either forged or cast B-RB crankshafts because the Hemi crank has an 8-bolt crank flange. All flex plate to torque converter bolts must be loctited. Also, all flywheel to crankshaft bolts must be loctited.

Flywheel attaching screw set (8 pieces)	
1⅜" long	P4120629
7/8" long	P4120630
Flex Plate Screw package (crankshaft screws and converter screws)	
8-bolt crank	P4120464
6-bolt crank	P4120465

Forged crankshafts — The standard 10½" flywheel is PN 2264597. The 440-6 Bbl. and the 1970-1971, 440-4 Bbl., high performance engines require a specially balanced flywheel, PN 3410837, which uses a 10½" clutch. The Hemi torque converters can be installed on the "B" and "RB" engines by using a special flex plate, PN P2466326. Four PN 6024318 screws are required to attach this drive plate to the Hemi torque converters.

Cast Crankshafts — the cast crankshaft was introduced in 1971 in the 383-2 Bbl. and has since been used in the 400-2 Bbl. and 4 Bbl. The cast crankshafts have not been used with the manual transmission. The cast cranks also have a 6-bolt flange, but they use specially balanced torque converters. Standard torque converters or flywheels cannot be used with the cast crankshafts because of the special balancing. In 1974 the cast crank was introduced into the 440 engine. It also uses external balancing similar to the 383 and 400. All three of these engines can be balanced internally by using Mallory metal. An internally balanced engine can use the same flywheels or torque converters as a forged crank engine.

The externally balanced flywheels are covered in Bulletin #7. The externally balanced torque converters can be replaced with performance converters by using torque converter balance weight and template package, P4120241.

For some racing applications an aluminum flywheel is desirable. A 6-bolt aluminum flywheel, PN P3690469 is designed for the B-RB crank flange and weighs 11 lbs.

S. Intake Manifold

All "B" or Lo-block intake manifolds are interchangeable as are all "RB" intake manifolds except the max. wedge Super Stocks. However, an "RB" manifold will not fit on a "B" (Lo-block) engine. The Stage I, II or III heads need one of the manifolds that were designed for these heads. Since the max. wedge super stock heads were only used

on the "RB" engine, there is no big port manifold available for use on the Lo-block engine. The standard manifold will not work with the "Stage" heads because the ports in the head are so much larger than the manifold runners. See Figure 2-1. The max. wedge intake gasket is PN P4120892.

The 1969-1971, 440-6 Bbl. manifold will fit any "RB" engine. Edelbrock also has a 6-Bbl. manifold available for the 383-400 engine which is carried in the Direct Connection program under PN P3571051. There are two versions of the 6-Bbl., one made of aluminum, PN 3412046; and one made of cast iron, PN 2946275.

The new "B" and "RB" engines use a Carter Thermo-Quad carburetor. The manifold that is used on the 1972, 400 with the Thermo-Quad carb is PN 3614047 and will fit any lo-block engine. The 1973, 440 also uses the Thermo-Quad carb and uses manifold, PN 3698585 which will fit any "RB" engine. Similar manifolds are used on the 1974-1978, 400 and 440 engines since the Carter Thermo-Quad carb was the standard carburetor.

The Holley Dominator, single 4-Bbl. manifolds are the best 4-Bbl. manifolds for racings: "B" engine, P4007937; "RB" engine, P4007938.

The ultimate all-out race manifold is the 8-Bbl. tunnel ram. They are made by Weiand: "B" engine, P4120789; "RB" engine, P4120790. See later section for more racing intake system details.

T. Engine Mounts

All B-RB engines used the same mounting lugs. The general design consists of three ears or lugs on each side of the block to which the mount bracket attaches. The bracket changes with the year and model of car, but the lugs are all in the same location.

The only exception to the above information is the 1967-1968, 383 A-Body engines which had a unique left side (driver's side). It screwed into a boss just ahead of the oil pump boss. These parts are no longer available and the D.C. "B" engine into A-Body K-member, package P4007935 uses the standard lugs on the side of the block. See Bulletins #28 and #39 for more information.

U. Special Gaskets

Some intake manifold leaks occur when the intake manifold is removed or replaced, especially with the aluminum 440-6 Bbl. intake manifold. In most cases the intake leak causes high oil consumption because it will suck oil into the inlet port from the valley chamber below the standard breast-plate intake gasket. This type of leak can be solved by using the special intake gaskets, PN 3514186. These are to be used in conjunction with the standard breast-plate type gasket.

The standard steel B-RB breast-plate type intake gasket will occasionally crack and split causing oil to escape from the engine. This splitting is caused by vibration. A fiberglass "sandwich" is added above the gasket and below the intake to help solve.

Very little head gasket problems are encountered with the B-RB engines and they all can use the same head gasket, PN 3614284. This is a .017-.019" thick steel shim gasket. This gasket works well in all applications. However, if the engine's compression ratio is desired to be lowered, the new Fel-Pro head gasket, P4120754 is recommended because it is approximately .040" thick.

Production B-RB engines don't use exhaust manifold gaskets with the production cast iron exhaust manifolds. With exhaust headers an exhaust header gasket, PN P3690938 will be needed. All B-RB engines will use the same exhaust gasket.

V. Engine Paint

Some of the Chrysler engine paint is hard to find in the local speed shops. If you don't want to switch colors, then try the new D.C. engine paint: Hemi Orange, P4120751; Blue, P4120752 and Black, P4120753.

W. Exhaust Manifold

Many different exhaust manifolds have been used on the B-RB engines. All the manifolds are interchangeable, but may not line up with the car's exhaust system. The correct exhaust manifold should be selected to match the car in which the engine will be installed; i.e., Dart, Barracuda, Charger, etc.

The best cast iron exhaust manifolds produced for the B-RB engines were used on the 1962-1964 max. wedge engines, but they are no longer available. The next best exhaust manifolds are the ones used on the 1968-1970 383-440 Road Runner, Charger, Super Bee, GTX, R/T high performance packages. These manifolds, PN 2806898 right and 2843991 left will not fit into every car or mate up to all exhaust systems without custom modifications.

X. Oiling

All "B", "RB" and Hemi oil pumps are interchangeable. The B-RB engines use a 3/8" diameter pick-up tube, while the Hemi uses a 1/2" pick-up tube. The B-RB engine (1968-1976, 383-400-440 high performance engines) use a windage tray, PN 3751236 which will fit any "B" or "RB" engine.

All B-RB engines (except for the 440-6 Bbl.) use a 45 lb. (red) oil pressure relief spring. The 440-6 Bbl. and Hemi engines use a 70 lb. (black) oil pressure relief spring, PN 2406677 which can be installed in any B-RB oil pump.

All B-RB engine oil pans are interchangeable except for the pan's effect upon the in-car installation (i.e. interference with steering link or frame). General Oiling-see figure 2-7.

Y. Fuel Pump

All B-RB Hemi engine fuel pumps are interchangeable. The 426 Hemi fuel pump, PN 2585118 may be installed on any B-RB engine.

For high performance or racing applications, a special high delivery rate mechanical pump, PN P4007039 is recommended along with the Carter electric fuel pump, PN P4007038. See a later section for further details or refer to Bulletin #43.

III.
OFF-ROAD MODIFICATIONS

In this group of sections we will discuss modifications using the parts mentioned earlier and some special racing parts which will provide increased power and durability. We will look at the various systems separately first and then tie these systems together into the various complete race engine packages.

A. Cooling System

The stock cooling system is adequate to keep operating temperatures to accepted levels. However, several components may be changed to reduce power losses in the system.

A viscous fan drive, package P4120758 will bolt on in place of the stock components to reduce the fan resistance at high engine speeds. A similar effect or result can be obtained by using a plastic flex-fan. The viscous system is more efficient.

The stock water pump impeller can be replaced with PN 2402923 which is used on air-conditioned engines. This smaller impeller takes less power to drive, especially at high engine speeds.

The 1972-1978, 400 and 440 engines all use the A/C type water pump.

For most high performance off-road applications, a high engine temperature is undesirable. For these applications install a 160° thermostat, PN 3514177 which will help the engine run cooler.

NOTE: Most "summer" thermostats currently available are in the 180-185° range. Winter thermostats are around 195°.

For high speed race engines, a small diameter crank pulley and large diameter alternator and water pump pulleys are desirable. Aftermarket sources have these pulleys available and they feature a deep groove design. A race engine should use a 3/8 fan belt.

For drag strip use only, the water pump can be cut down .200" for less friction and less horsepower loss. There is also an electric fan-water pump kit which replaces the standard fan belt so that the power that is absorbed by the water pump doesn't come from the crankshaft which increases the engine's horsepower output.

B. Fresh Air System

A good fresh air system can increase a car's performance without affecting much else. A hood scoop such as that used on the 1969 Road Runner or Super Bee 440-6 Bbl., PN P4120199 (scoop only) can be attached to your standard hood. The air cleaner should be modified so that it is sealed to the hood. Foam rubber can be used as the seal. There are also complete hoods for some cars that already have a good scoop such as the 1969 Road Runner or 1970 Challenger T/A. Small scoops are of no value. A scoop should have 30 in.^{2} of opening to be effective. See Bulletin #14.

C. Fuel System

A race car in Super Stock or Modified Production or similar race cars should use two Carter 4594 electric pumps, PN P4007038 in parallel. Parallel means having two inlets and two outlets rather than one pump feeding into the second pump. The mechanical pump should also be used. A high capacity mechanical pump, PN P4007039 is available to replace the standard pump. The recommended fuel line is 3/8" diameter and it should be the same diameter from the electric pumps to the carburetor(s).

The Holley high capacity, high pressure, electric fuel pump, P4120227 (includes regulator) is also available. If the Holley pump is to be used, a regulator must also be used — one per carburetor. The Holley pumps should always be used in pairs and set up in parallel.

The electric pump(s) should be hooked up so that it only works when the key is in the "ON" position. A separate switch in conjunction with the ignition key is optional. Refer to Bulletin #43 for more information.

D. Induction System

For drag racing cars it is recommended that the heat

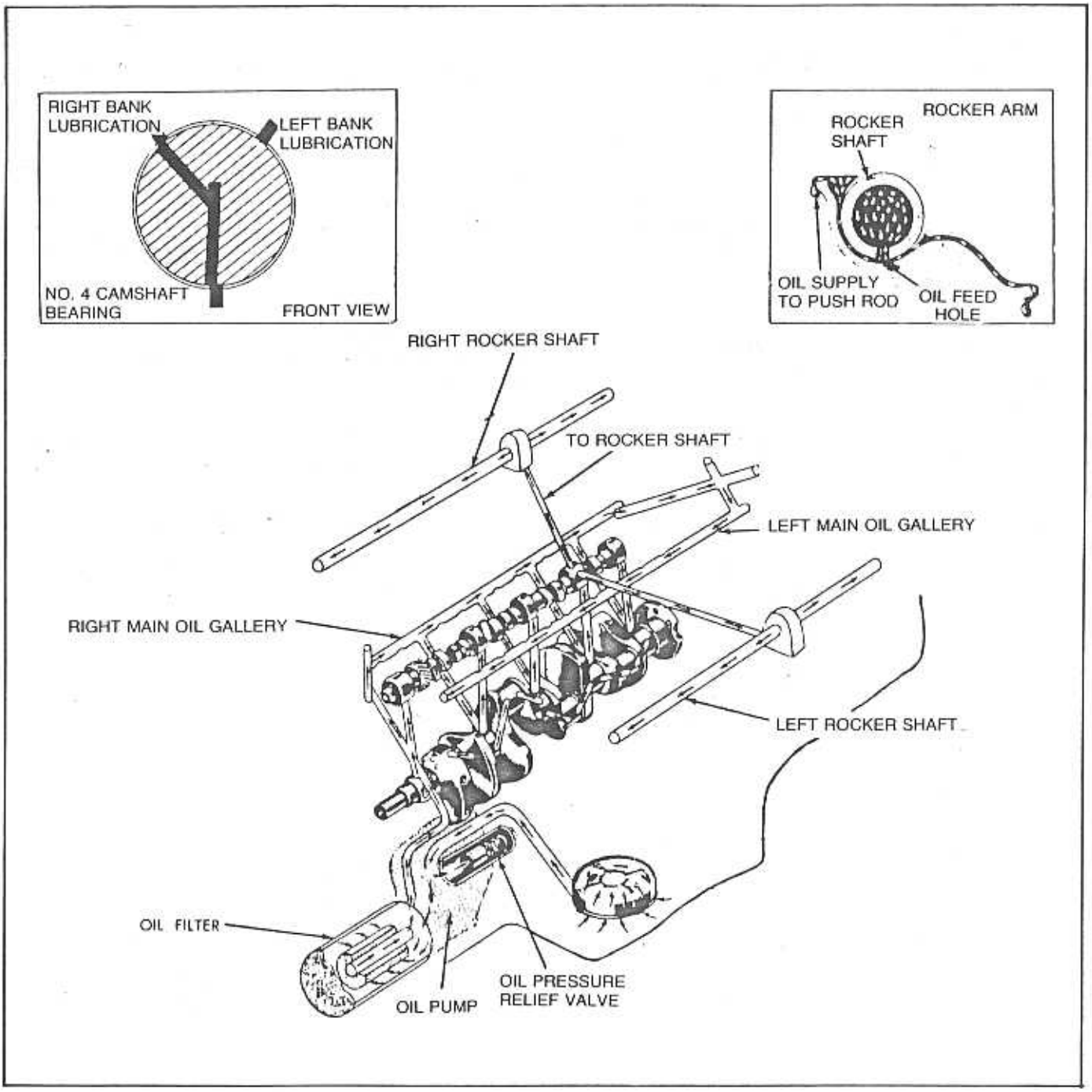


FIGURE 2-7

"B-RB" ENGINE (361-383-400-413-426-440) OILING SYSTEM
NOTE: 426 HEMI IS THE SAME EXCEPT FOR ROCKER SHAFTS, ROCKER ARMS, ETC.

cross-over in the intake manifold be blocked. Block off exhaust cross-over in intake manifold by either putting shims in the gasket or by brazing a plate into both sides of the cross-over in the intake manifold. Use D.C. package P4120476 which is made of stainless steel, with the manifold block-off at the gasket.

The best shim material is thin stainless steel. With the heat cross-over blocked, the choke will no longer function. The carburetor will usually have to be rejetted for racing. It usually causes the car to run poorly when dead cold which is why it is recommended for racing cars only. It also should not be considered for cold weather use.

When a car is raced off-road, there always seems to be more vacuum taps on the carburetor than are needed. To block these taps, use D.C. plug and cap package P4007901.

1. *Induction System "B" Engine*

   The older 1958-1967 "B" engines can show a performance increase by using the 1968-1971 Road Runner intake manifold, PN 2843684 and AVS carb. or the 1972-1973, 400-4 Bbl. manifold, PN 3614047 and Carter Thermo-Quad carb. The performance of the 1968-1970 Road Runner, 335 hp, 383 engine package will improve by using the larger Carter AVS from the 375 hp, 440, PN 2863838.

   The older 1962-1967, "B" engine, 4 Bbl. carbs were Carter AFB's. They can be rejetted for better performance by using strip kit, P4120238.

   The 1972-1978, 400 intake manifold and Carter Thermo-Quad carb., PN 3614139 will also increase the performance of all the 383's. The Thermo-Quad carb is the best single 4-Bbl. package for general high performance usage.

   The Edelbrock DP-4B, PN P2836149 used with the 750 cfm Holley carb, PN P2836172 will out-perform the standard induction system, but should only be used on a "bracket racer."

   These two "P" part numbers are no longer available from Direct Connection. The manifold is still available from Edelbrock. D.C. currently carries a replacement from the carb listed above which is also a 750 cfm and has double accelerator pumps, P4007900.

   Another single 4-Bbl. manifold for a Super Stock "B" engine is the Edelbrock STR-15-4, P3690189 top, P3690249 bottom. This manifold can be used with the 1971 Holley carb, PN 3512842. The carburetor calibration is included with the manifold. Also see bulletin #34.

   The Edelbrock Torker will make almost as much power as the STR-15-4 but offers improved throttle response, so it is recommended for use with the automatic transmission in Super Stock or bracket racing.

   The *Best* racing single, 4-Bbl. manifold is the Holley dominator, P4007937. In a race car it will outperform any of the other manifolds listed above. However, if the Torker is currently being used, the gain for the Holley manifold is small.

   The STR-15 manifold features interchangeable manifold tops so that the same base can be used with a 2-Bbl. carb, top PN P3690190, or with the in-line two, 4-Bbl. 343 hp, 383 setup, top PN P3690191.

   The STR-15-8 for the 383-8 Bbl. is the best manifold available for that Super Stock package. The highest output from the engine (SS 383-8) will be gained by using a modified Weiand 6-Bbl. However this manifold is expensive to modify and results in hood clearance problems on most cars.

   The best all-around induction system for the "B" engine is the 6-Bbl. The 6-Bbl. 383 is not legal for Super Stock competition but still offers a good performance increase over a single 4-Bbl. The 440-6 Bbl. manifold will not fit the Lo block, but there is an Edelbrock 6-Bbl. manifold, PN P3571051 for the Lo block engines. The best carbs to use on the Lo block, 6-Bbl. are from the 1971, 440-6 Bbl., PN 3418544, front; PN 3418550, center/automatic; PN 3418549, center/manual; PN 3462373, rear. Any set of 440-6 Bbl. carbs will work as well as if these can't be found.

   For maximum power, two 4-Bbl. carbs on a tunnel ram manifold should be used. The Weiand tunnel ram, (top and bottom) is P4120789. For best performance the manifold should be ported out to the size of the port in the head. It is difficult to get the tunnel ram to leave hard with an automatic. This has been worked out and is covered in Bulletin #34 (1982 edition).

2. *Induction System "RB" Engine*

   The early model 413 and 426 engines will show a performance improvement with the installation of the 1968-1972, 440 hp carb and manifold or the 1973 H.P. manifold, PN 3698585 and Carter Thermo-Quad carb, PN 3698336.

   For more performance improvement, the Edelbrock CH-4B, PN P2836150 can be installed with a 1-11/16 Holley carb, PN

P2836172. These parts are no longer available from Direct Connection. The manifold is still available from Edelbrock. The large race Holley carbs to use as substitutes are P4007900 which is a 750 cfm double pumper and P3571012 which is an 850 cfm carb with vacuum secondaries.

The Carter TQ carb and manifold setup is the best overall system for general high performance, but the big Holley offers slightly more horsepower.

Another Super Stock, single 4-Bbl. manifold is the Edelbrock STR-14-4, PN P3690248, bottom and PN P3690186, top. This STR-14 manifold bottom can be used on a 440-6 Bbl. Super Stock by using a new top, PN P3690187. The 440-6 Bbl. induction system is the best all-around system for the "RB" engines. It uses three Holley 2-Bbl. carbs. (See previous section on "B" engines for part numbers.) Any set will perform well.

For single, 4-Bbl. racing usage, the Edelbrock Torker will make almost as much power at the STR-14-4 and offers improved throttle response.

The *Best* single 4 Bbl. racing manifold is the Holley Dominator, P4007938. In a race car it will out-perform any of the manifolds listed above.

A two, 4-Bbl. tunnel-ram setup will provide the maximum amount of horsepower from the "RB" engine. The Weiand tunnel ram, P4120790 should be ported out to match the port size in the head. The "B" tunnel ram is P4120789.

3. *Carburetion*

For any racing application, the carburetor must be specially jetted for proper fuel distribution. The intake manifolds mentioned above can be used with different carburetors, aftermarket manifolds installed, or the manifold heat blocked, all of which require the carb to be jetted differently for each application. The following sections will cover the more popular choices.

SPECIAL NOTE:
Because of the constant changes that occur in racing, the latest up-to-date carburetor and intake manifold information for the 383-426-440 racing packages is covered in tune-up tip No. 34.

The best all-around carburetor systems for dual purpose vehicles such as "street machines" are the 6 Bbl. and the TQ. Any change to the exhaust system, inlet systems or camshaft may need to have the carb readjusted or rejetted. Helpful jetting packages are as follows:

	Carter AFB	P4120238
	Carter AVS	P4120239
1972 & up	Carter TQ	P4120240
	Holley 440-6 Bbl.	P4007671

In previous editions of the B-RB engine bulletin we have included carburetor rejetting tips. Since the last edition we have come out with a special bulletin on carburetor and manifold modifications (#34). Therefore starting with this issue all the carburetor tips will be included in Bulletin #34. Because of its popularity and uniqueness, we will cover the 440-6 Bbl. in general. More detail tips are availale in Bulletin #34.

The 440-6 Bbl. setup is the best choice for off-road performance enthusiasts. The 1970-71 carbs are the best choice and the proper jetting is listed in bulletin #34. The aluminum Edelbrock manifold is PN 3412046. Some of the 1970-71 cars have been built with a cast iron version of this manifold although all the 1969 440-6 Bbl's had the aluminum manifold. The other items required are:

Installation Kit:
Manual, PN 3412099;
Automatic, PN 3412100

Air Cleaner PN 3412058.

Above parts no longer available.

When using the standard aluminum Edelbrock 3-2 Bbl. manifold on the 440 with Holley carbs with air cleaner and no modifications to the engine, the following rejetting for maximum off-road performance is required:

	Throttle Side	Diaphragm Side
Front Carb MMO**	.089 Drill	.089 Drill
Center Carbs — Jets	#63	#63
Center Carbs — PVCR*	.043 Drill	.052 Drill
Rear Carb — MMO	.093 Drill	.086 Drill

* Power Valve Channel Restriction
** Main Meter Orifice. (See Figure 2-8)

NOTE: In all cases the proper size drill is to be used to open up the PVCR, which is located behind the power valve.

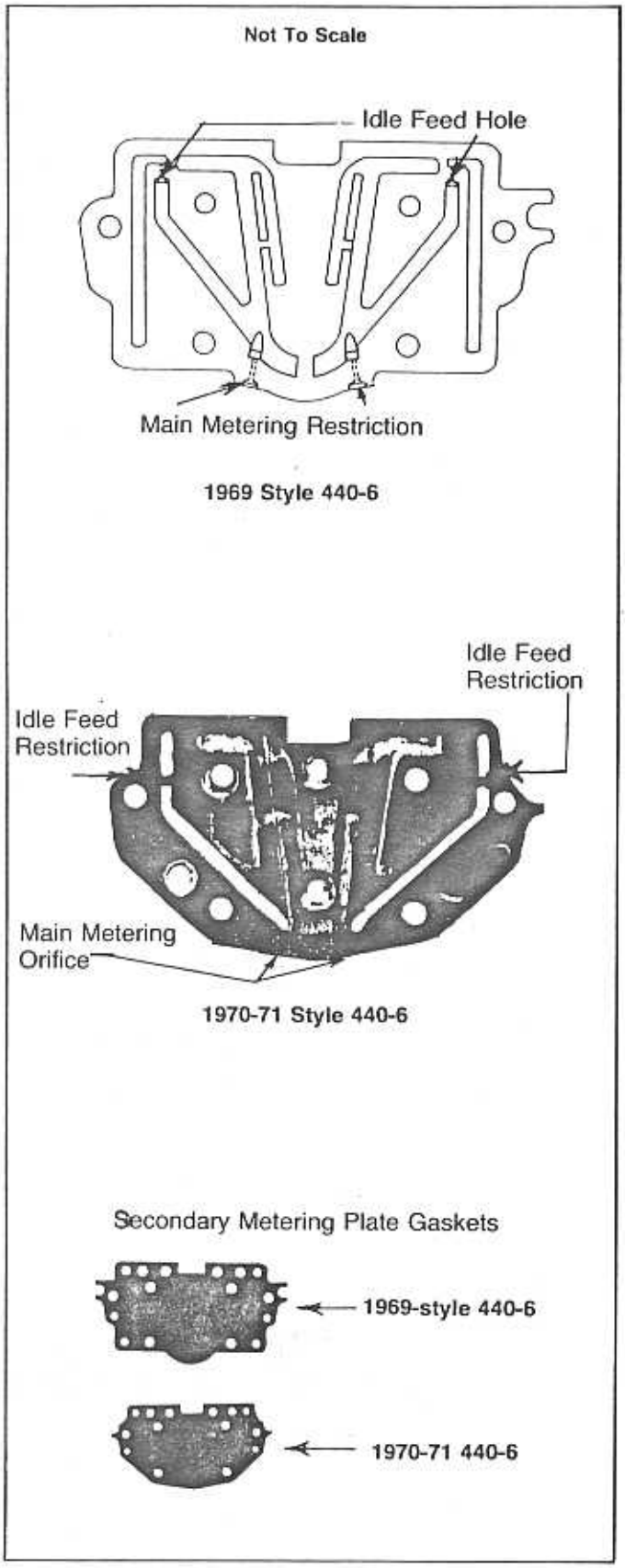


FIGURE 2-8

The calibrations are not intended for race purposes or with headers or other similar modifications. Also, if the air cleaner is removed, these calibrations will no longer work effectively and require the carb to be reworked. This rework is permanent, requires special tools and should only be done by a carb expert, or use Bulletin #34.

On some 1969 and possibly a few 1970, 440-6 Bbl., the end carbs tend to stick closed. A production change was made which solves this problem and most 1970, 440-6 Bbl. and all 340-6 Bbl. should come equipped with these carbs. There are two fixes on these new carbs, one for the kill bleed and one for the throttle plate. The kill bleed actuates the end carbs and the change made allows these end carbs to open sooner. Carbs with this change can be identified by a dash one (-1) after the part number of the 1969 models. All 1970 models have this change. The other change to the throttle plate can be identified in two ways. First, there is a number stamped on the vertical face over the float bowl, and if this number is greater than 3149, it has the new throttle plate. By greater than 3149 it is meant newer, since that number stands for the date it was made, in this case the 314th day of 1969. The other way to identify the new throttle plate is to remove the carb and turn it upside down. The number 199 stamped on the bottom side of the throttle plate means that it is one of the new plates. The number stamped on the older plates is 266.

To determine if the end carbs are stuck, the throttle must be opened manually with the engine shut off. This can be done by gripping the linkage at the center and the end carb so that the throttle of the center carb is fully open and then opening the throttle of the end carb, being sure to keep the center throttle open at the same time. If a loud "pop" or "snap" is heard, then the throttle was stuck and will stick again. The *obvious* solution to this sticking problem is a set of new carbs, but the old ones can be fixed. Remove the end carbs and then remove the throttle body. The throttle bore should then be sanded down to the smoothest finish possible. This can be done by starting with 400 paper and then using 600 paper. This is a very difficult procedure and may not result in instant success. Also, as another solution to this problem, the new throttle blades (#199), can be purchased. If this is done and they are installed, the throttle body should be sanded just as a precautionary measure.

4. *383-400-426W-440 SS and Other Racing Packages*

   These packages are covered separately in tune-up tip No. 34. They are constantly changing and must be kept up-to-date, and TUT No. 34 contains the latest information available.

E. Ignition System

Chrysler's new electronic ignition system which was introduced on the "B" engine in 1972 is the best ignition system available. A competition version of this ignition is available which includes a mechanical tach drive distributor. An adapter is available that enables the "RB" engine distributor to be used on the Lo-Block "B" engine. The parts required are as follows: Distributor, PN P3690201 (Mech. Tach. Drive); Control box, PN P4120505; Wiring Harness, PN P3690152; and a ballast resistor. (Other control boxes optional.)

Special Note: New aluminum "RB" mechanical tach distributor is available in new D.C. (1983) catalog.

The "RB" to "B" distributor adapter kit is PN P3690275.

The complete kit includes all the above parts for "B" engine with mechanical tach, PN P4007908; "RB" engine with mechanical tach, PN P4007909.

The vacuum advance model electronic ignition conversion packages, PN P3690427 for the "B" engine and PN P3690428 for the "RB" engine, include the same pieces listed above except that the vacuum advance distributors, PN 3690431, "B" engine and P3690432, "RB" engine are used in place of the mechanical tach drive unit.

The distributors, single, dual point, or the new electronic, can be recurved by disassembling the distributor and installing spring kit, PN P2932675. This kit provides total centrifugal advance by 1500 rpm. The H.P. electronic distributors do not need to be recurved since it has a race-advance curve built into them.

The race electronic distributors with mech. tach. drive are recurved to have full advance before 1500 rpm while the vacuum advance models are recurved to have full advance by 2000 rpm which is more suited to general high performance use.

The maximum total spark advance for the B-RB engines should be set to 38°. The damper should be clearly marked for both TDC and 38° advance.

If a timing tape, P4120993 is not used, the 38° mark can be created by measuring 2⅜" from the TDC mark.

The spark plug recommendations for the stock B-RB engines are:

		Standard	Colder
All	440	J11Y	J10Y
1972-73	440-2 Bbl.	J13Y	J12Y
All	383-2 Bbl.	J14Y	J13Y
All	383-400-4 Bbl.	J11Y	J10Y

For racing or other high performance applications with a modifed, non-stock engine, it may be necessary to use a spark plug which is one or two steps colder than standard. Colder than standard plugs used under normal type driving conditions will provide short plug life as they are more likely to foul. If plug fouling is experienced with a high performance, 4-Bbl. engine under normal conditions, a warmer plug may be necessary to extend plug life.

Race Spark Plug Recommendations Are:

		Coldest	Hottest
B-RB	Super Stock-Low Comp. Ratio	J63Y	J9Y
B-RB	Super Stock-High Comp. Ratio	J61Y	J63Y

The plug gap should be .040" with the high output coil, PN P3690560 and .060" with the multi-spark ignition.

The multi-spark ignition system is a very high energy version of the electronic ignition. It is called the multi-spark because it fires the plug more than once per two revolutions. It requires the electronic distributor (either vacuum advance or mech. tach drive) and the electronic ignition wiring harness. The Multi-Spark uses a different control box and the standard coil is replaced with a transformer. These special "coils" for the Multi-Sparks are made only by Mallory, Autotronics and Accel. A high performance stock-type coil will not operate a M-S system properly. All the pieces needed to convert a standard electronic ignition system to a multi-spark system are included in the conversion package, PN P3690728. This M-S unit was called a 404 BC Multi-Spark. In 1978 we carried the newer MSD-7 Multi-Spark. Since then we have dropped all Multi-Spark parts in favor of the new Chrysler Gold Box P4120600 ignition. The Gold Box is designed to match the performance of various race systems at less expense with more reliability.

One special consideration is that if the engine used is a 440-6 Bbl. in Super Stock, the Multi-Spark (404 BC) is very highly recommended especially with the automatic. Unfortunately Autotronics no longer makes this unit and their other M-S units such as the MSD-7 won't perform as well in the 440-6 Bbl.

The best ignition "timing" system for the high rpm, high compression ratio (over 12.0 to 1) manual transmission Modified Production or similar engine is the crank trigger electronic ignition system. With this system the timing of the plug firing is done at the front of the crankshaft. The distributor is still used, but it only sends the firing signal to the correct spark plug. This makes the cylinder-to-cylinder spark scatter virtually *zero*. It also makes the timing very steady because the distributor shaft no longer turns the timing mechanism. This becomes even more important with the poorer quality gas that's available in the 80's.

All electronic ignition systems require a special voltage regulator, PN P3690732 when installed on the 1969 and earlier cars. This is a constant output voltage regulator and, if it is not used, the control box may be burned out.

The spark plug location affects the flame travel in the combustion chamber. The "B" engine plug location is low (at the edge) in its wedge similar to the most popular race small-block. This small-block obtains a performance gain for moving the plug up in the chamber. It is expected that the B engine would react similarly, but we have not tested it. See figure 2-25.

A good ignition is only as good as its spark plug wires. There are two types of high performance spark plug wires available, metal core and suppression. The suppression wires, PN P4286525 are a good choice for a general high performance car. A race car must use solid metal core wires, P4120716 to obtain the high rpm performance required. The spark plug wires should not be crossed one over the other anywhere between the distributor cap and the plugs. The wires should be kept away from any metal object. If the plug wires do get near metal, such as the valve cover, then more insulation should be added in the area of contact. These tips on plug wires *must* be followed if the high energy ignition systems, such as the Multi-Spark or Chrysler Gold Box are to be used.

A new lightweight battery-in-the-trunk kit, PN P3690934 is available and a good investment for a bracket racer.

The best *race* ignition system is the Chrysler Super Gold Box, P4120600. It features all the performance of the MSD-7 at a much lower price. It is used with the electronic distributor and the crank trigger. It does require the race coil, P3690560. It is wired the same as the race chrome box.

Further information is available on the crank trigger in race *Bulletin #29* and race ignition, *Bulletin #25*.

F. Oiling System

The stock lubrication system will be adequate for normal operation. However, if the car is to be raced frequently especially with extended operation in the upper rpm range, it will be necessary to perform several modifications to insure an adequate and effective oil supply which means safety and life to your engine (i.e. life insurance).

For increased oil flow to the rod bearings on all engines, install upper main bearing shells (with oil groove) in both block and main bearing caps. This is particularly true with the "B" engine, except with the D.C. bearings, but the "RB" engine can use the Hemi main bearings which are fully grooved. Part numbers listed in earlier section. The crank itself should not be grooved because it weakens the crank.

Use only high detergent and additive engine oil. The oil must meet MIL Spec MS-DG. For increased life, use 30 weight viscosity only. Use SAE 40 for 8-Bbl. modified engines. Do *NOT* use viscosity improver oil additives. The only oil additives you should consider using are anti-scuff additives, such as Chrysler Parts Engine Oil Supplement, PN 3419131 or Alemite CD-2 or special cam break-in oil (Lubrizol), PN P3512626. Note: Be sure to drain break-in oil once engine is broken in, and replace with standard quality oil.

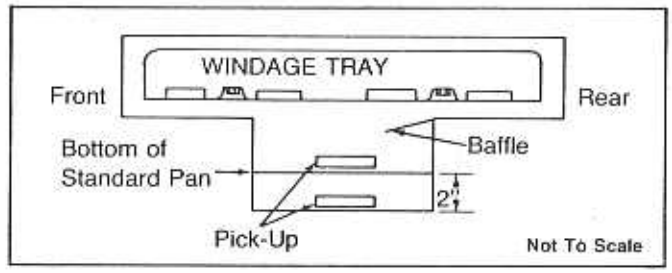


FIGURE 2-9

INCLUDE WINDAGE TRAY WITH THIS PAN MODIFICATION!

1. *Standard Pan*

   This pan can be helped by reworking the sump so it is 2" deeper. See Figure 2-9. A longer oil pick-up must also be installed at the same time. A deepened pan (7 quart), PN 2951564 can be purchased from your local Chrysler parts dealer. With this pan the pick-up must also be lengthened, or a strainer and pipe assembly, PN 3512251 which is designed for use with the deepened pan, can be purchased at your Chrysler dealer. With any oil pan capacity or shape change, the dipstick should be carefully

recalibrated. Be sure to fill oil filter before calibrating.

With either of the above pans installed in the car, the ground clearance will be reduced and the pan will no longer be protected by the K-member. For added pan protection, a skid plate should be added to the bottom of the K-member and the vehicle should be driven with increased care.

In the stock pan, especially the deepened pan, the rear acceleration baffle is very important. It keeps the oil from running up into the #7 and #8 cylinders and slowing down the last rod journal with increased drag. The baffle *must* be sealed to the three walls (back and two sides) of the sump or it becomes useless.

2. *Race Oil Pan*

The race oil pan should be designed similar to Figure 7. The first item to check before building a race pan is to determine the lowest point of the connecting rod travel and the relationship of this point to the pan rail. The dimensions given in Figure 2-10 are measured from the lowest point in the rod travel and not from the pan rail. This means that the pan must be made deeper than the dimension shown in the figure by the amount that the lowest point in the rod travel is below the pan rail or bottom of the block. With the B-RB engines, the pan rail can be assumed to be even with the lowest point in the rod travel.

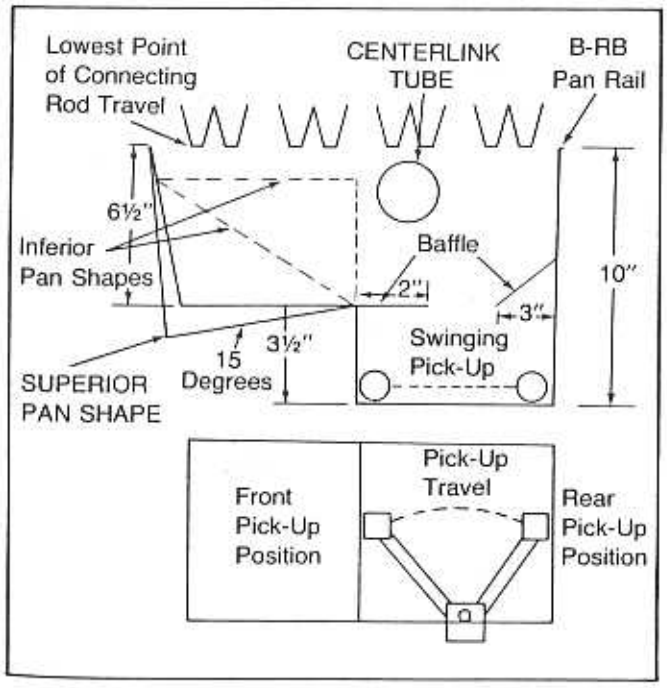


FIGURE 2-10

The in-car clearances should always be checked carefully before making the pan. The important items to watch for are header clearance, steering linkage clearance, K-member clearance and ground clearance. The K-member will interfere with the front of the pan requiring a notch or slope in the front of the pan. This notch should be kept to an absolute minimum or eliminated completely if at all possible.

The steering center link will usually pass through the center of the pan. This can be done by welding in a tube through the pan. Again, this tube should only be large enough to allow the installation of the center link and also to provide clearance during the lock-to-lock travel of the steering linkage. If the rules allow it in the class, the engine can be removed and the center link dropped or reshaped so that the tube through the pan is not required. Any re-shaping or changing of the center link should be done carefully so that the relationship of the end holes is not changed at all. If one of these points is moved, it will change the toe pattern of the front suspension which could be very dangerous in a drag vehicle.

The two baffles shown in Figure 2-11 should be sealed on the three sides next to the actual pan sides. No oil should be able to pass between the baffle and the side of the pan or the baffle is doing no good.

The swinging pick-up is part of the Milodon kit, PN P3412026. The oil sump should be designed so that the swinging pick-up can swing from the rear of the pan on acceleration to the front of the pan on deceleration. The pick-up should stop within ¼" of the back and front of the pan sump.

The sump should be filled with six to ten quarts of oil with eight quarts an absolute minimum for a Modified Production type, high speed engine.

Use oil pump relief valve spring, PN 2406677 plain or black color only, which is standard equipment in 1964-1971 race and street hemis and 1969-1971, 440-6 Bbl.

The Milodon oiling system package, P3412026 has dual external (to the pan) lines leading to the high volume pump. This pump requires a longer shaft or the oil pump drive.

DISTRIBUTOR & OIL PUMP DRIVE SHAFT & GEAR ASSEMBLY

P3571071 Distributor and oil pump drive shaft with gear and hardened tip — for use with flat tappet cams.

P3412064 Distributor and oil pump drive shaft with gear and hardened tip — extra length for use with Milodon Oil System.

P3690875 Distributor and oil pump drive shaft with aluminum-bronze gear and hardened tip for use with roller tappet camshafts.

P3690876 Distributor and oil pump drive shaft with aluminum-bronze gear and hardened tip. For use with roller tappet cams and Milodon Oil System.

The hardened intermediate shaft is required in high performance, high output engines because of the increased oil pressure. The standard one may shear off. The aluminum-bronze gear is required with roller camshafts because the roller cams are machined from a special material which will eat up the standard gear and spread metal particles throughout the engine.

The intermediate shaft bushing that is pressed into the block is PN 2863584.

Many of the newer drag race pans have a side-bucket. The oil pan's sump is extended on the right side (passenger side as installed in the car). See Figure 2-12. Just the sump is extended externally and the swinging pickup is extended internally. The major reason for this side-bucket design is to get more capacity from a shallow or limited-depth pan. It puts some of the oil reservoir off to the side (i.e. not directly under the crank) and the oil inlet is to the side and has a longer swing travel.

3. *General Oil Pan Tips*

   a. Windage Tray Installation

      Every high performance "B" or "RB" engine should have a windage tray. It goes between the oil pan and the block. Only the windage tray and two oil pan gaskets are required for installation. The only time a windage tray should *not* be used is with the real *race* oil pan. With the race pan, the windage tray should be removed resulting in increased car performance. If the car slows down when the tray is removed, the pan has been compromised too much and the tray should always be used with that particular pan.

      The Chrysler-developed windage tray, PN 3751236, is the best horsepower-for-dollar item available for engines and a real industry first. It will fit all 361, 383, 400, 413, 426 and 440 wedges with complete interchangeability. Basically, the windage tray provides increased horsepower by reducing oil friction on the crankshaft assembly at high speed. It's worth 15 hp at 6000 rpm! Remember, you must use two pan gaskets — one below and one above the windage tray.

   b. Bearing

      All wedge rod bearings are interchangeable, so you can use the 1970-1978 bearings in earlier engines. Main bearings are not interchangeable between Hi block wedges and Lo block wedges.

      426 hemi rod bearings can be used in all 383, 400 and 440 type wedge engines. The fully grooved hemi main bearings can also be used in the 413-440 type engines. The 383-400 cannot use hemi main bearings.

      Direct Connection fully-grooved, "B" main bearings are available. See earlier section for PN's.

      A long rotor, high volume pump, P4007177 is available for all B-RB engines. It gives a high delivery system for up to 7000 rpm use and fits the stock oil pump. It does not use a longer intermediate shaft and doesn't use external lines.

   c. Oil Pump

      All wedge (and hemi) oil pump rotors are the same. To boost oil pressure, the best method is to install the black (55-75 lb.) street hemi pressure relief spring, PN 2406677 in place of the standard red spring (45-65 lbs.). This is better than increasing the red spring pressure by washer spacing.

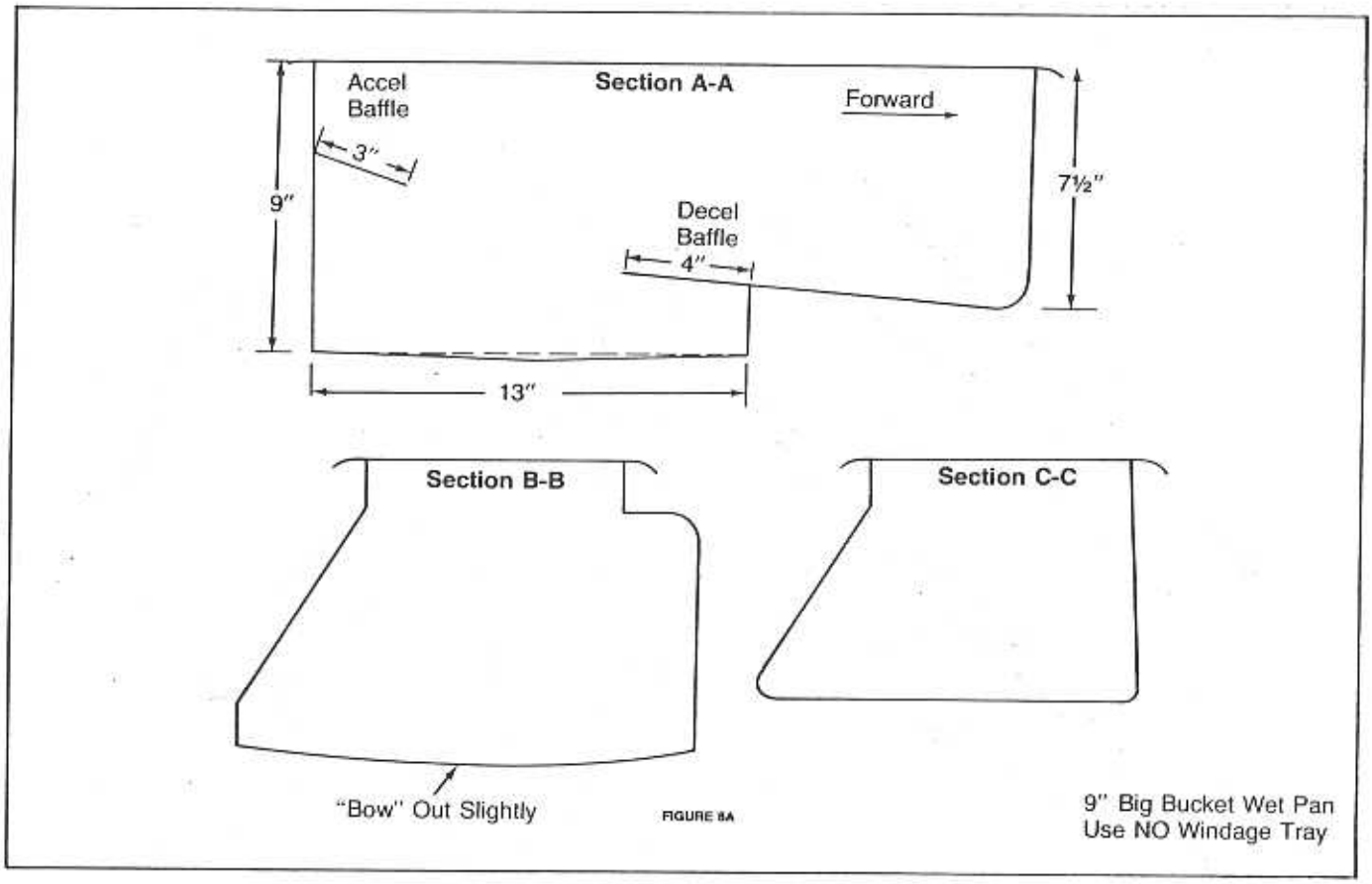


FIGURE 2-11

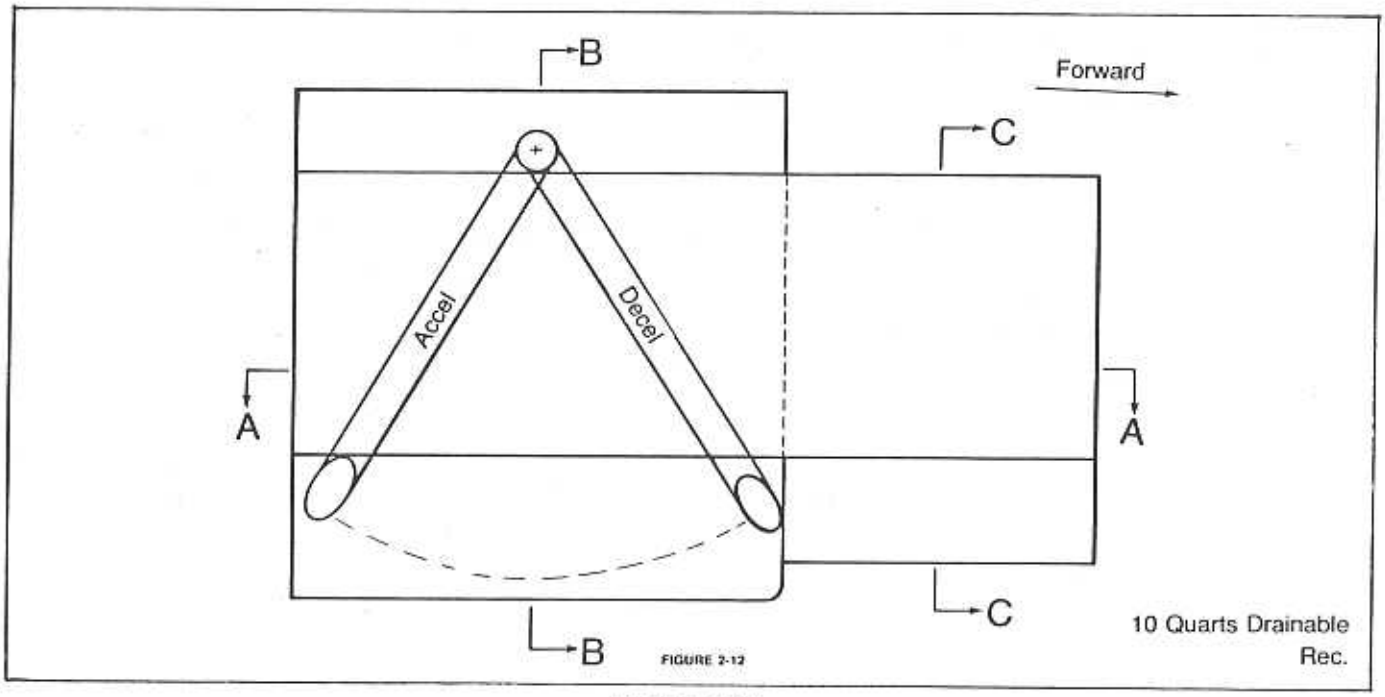


FIGURE 2-12

TOP VIEW

SIDE-BUCKET OIL PAN

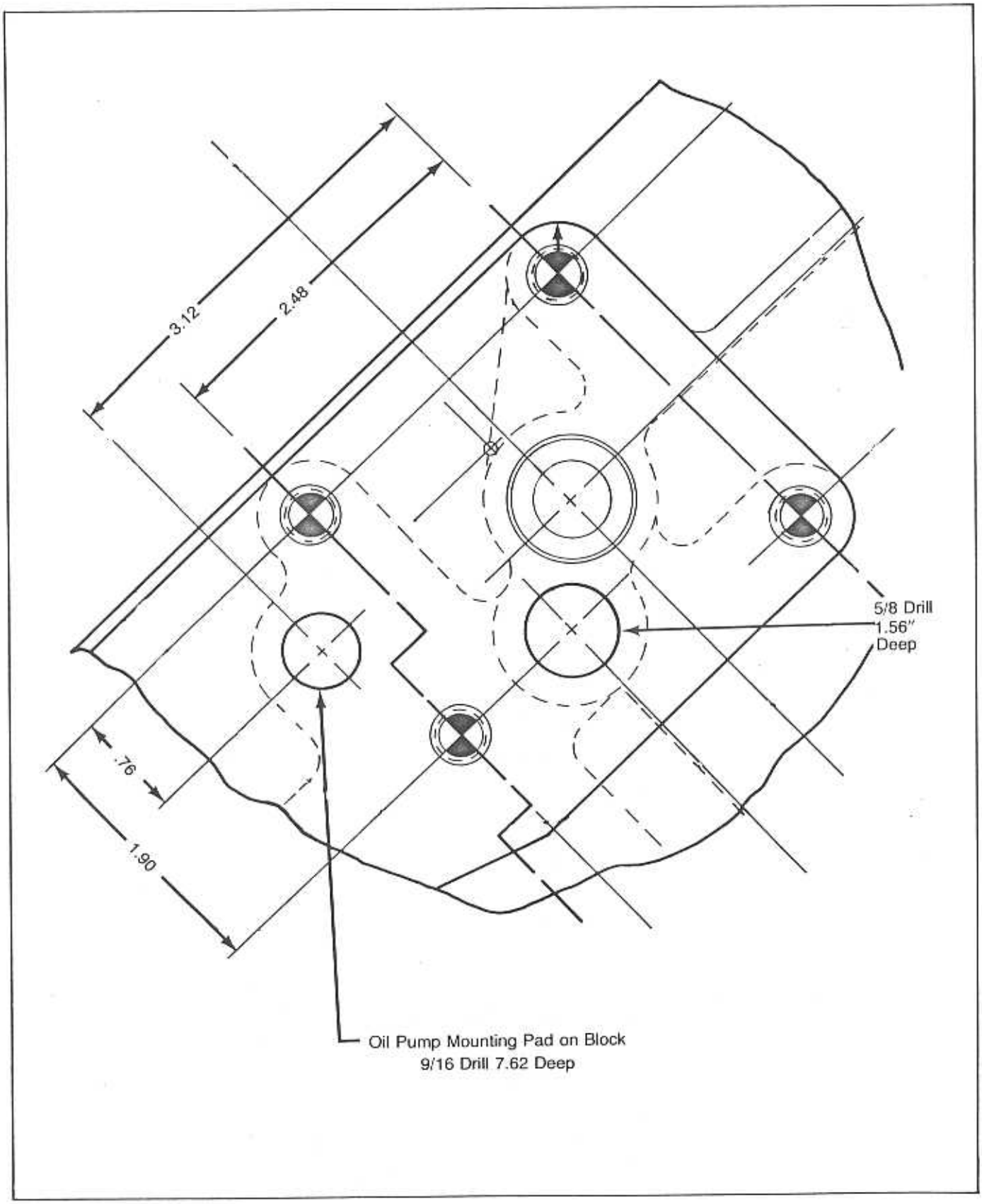

3.12
2.48
5/8 Drill
1.56"
Deep
.76
1.90
Oil Pump Mounting Pad on Block
9/16 Drill 7.62 Deep

FIGURE 2-13

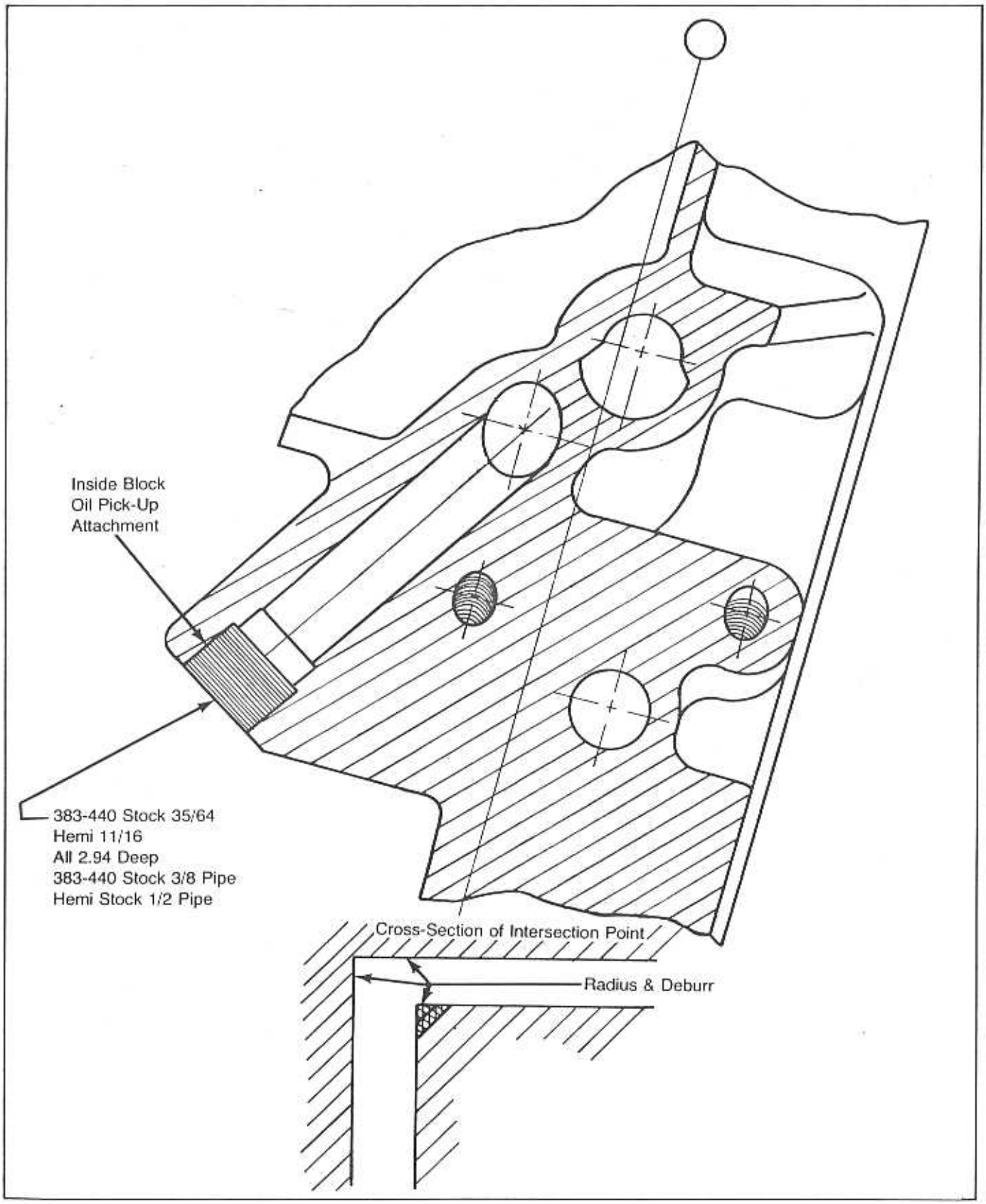

Inside Block
Oil Pick-Up
Attachment
383-440 Stock 35/64
Hemi 11/16
All 2.94 Deep
383-440 Stock 3/8 Pipe
Hemi Stock 1/2 Pipe
Cross-Section of Intersection Point
Radius & Deburr

FIGURE 2-14

d. Improving Stock Pump

The biggest restrictions for the stock pump or the long rotor pump listed above are not the pumps themselves but the pickup and block passages. All these systems use single line, internal oil feeds to the pump which restricts the oil flow. Less restriction on the inlet side of the pump will improve its output. The first step is to replace the stock 3/8 diameter pickup pipe with the Hemi's 1/2 diameter pickup by drilling out the hole in the block where the pickup screws in and tapping the hole with 1/2" pipe threads. If an actual hemi pickup is used, be sure that it fits properly at the bottom of the sump before the final oil pan installation is attempted.

The next step is to drill out the passage in the block above the 1/2 pipe threads to 11/16 (stock is 35/64). The 1/2 pipe inlet pickup can be installed without doing this. The third step is to radius and debur the intersection of this 11/16 hole coming up from the pickup attaching point and the 5/8 hole going into the block from the oil pump mounting face. It is recommended that the deburring tool be inserted from the oil pump mounting face because the intersection is 1.5" in from this face, while it is 3" from the pipe threads. See Figures 2-13 and 2-14.

e. Oil Filter

The D.C. high performance oil filter, P4007513 is a "shorty" design and is engineered to meet the demands of current heavy duty, high output engine assemblies.

f. Oil Pan Bolts

It always seems that when the oil pan is installed that many of the oil pan screws are missing. D.C. package, P4120613 has twenty screws with a nylon insert that are 9/16" long.

4. *Dry Sump*

A dry sump oil system should be used whenever a deep oil pan cannot be used. There is approximately 30 hp lost to a shallow wet sump pan making the dry sump a worthwhile investment.

The dry sump system consists of an oil tank, scavenge pump and a pressure pump. The oil pump for dry sump use is a multi-stage external assembly with two or three stages for scavenge and a pressure stage (optional — see later paragraph). Drag race applications require two scavenge stages. Circuit engines require three. The pump should be run at .5 to .6 engine speed. The drag pump has two 1.45 wide scavenge stages and a 1.2 or 1.45 pressure stage. The circuit pump uses three 1.45 scavenge and 1.45 pressure stages.

The tank for drag use can be as small as 5 quarts while a circuit tank should be 3 gallons.

The oil pan for drag and circuit is different, mainly in the pickup location and baffles. See Figure 2-15.

Now we have all the parts, let's see how it works. The pressure stage picks oil up from the tank, then to an external oil filter, then to the engine. The engine then gets oiled and dumps the oil back in the pan where the scavenge stages pick the oil up and return it to the tank. The tank is vented to the valve cover to equalize pressure.

On the B-RB engines (and Hemi) the high volume Milodon pump can be used in place of the pressure stage on the external pump. Then the standard filter can be used.

G. Short Block

When assembling a B-RB engine, most of the miscellaneous small parts, such as cam bearings, timing chain and gears, rear main seal, camshaft plug, and freeze plugs, are the same between the two groups of engines. Use hardware package P4007943 for the pipe plugs, dowel pins, cored plugs and other small parts that are helpful in the basic block buildup.

The short block is the largest building foundation in the engine. There are three major areas in the short block which are major contributors to maximum output and performance from the engine. Straight and round bores are the most important. The piston ring must seal to the cylinder wall *and* to the piston itself at all engine speeds. Lightweight reciprocating and rotating engine pieces will also increase the engine's performance, but must not be done by sacrificing durability.

1. *Block*

Having a STRAIGHT bore (no taper) that is ROUND is *the* most important step in building a race engine that produces a good horsepower output.

a. The first step in obtaining straight and round bores with the throttle open is to select a stress-relieved block. None of the

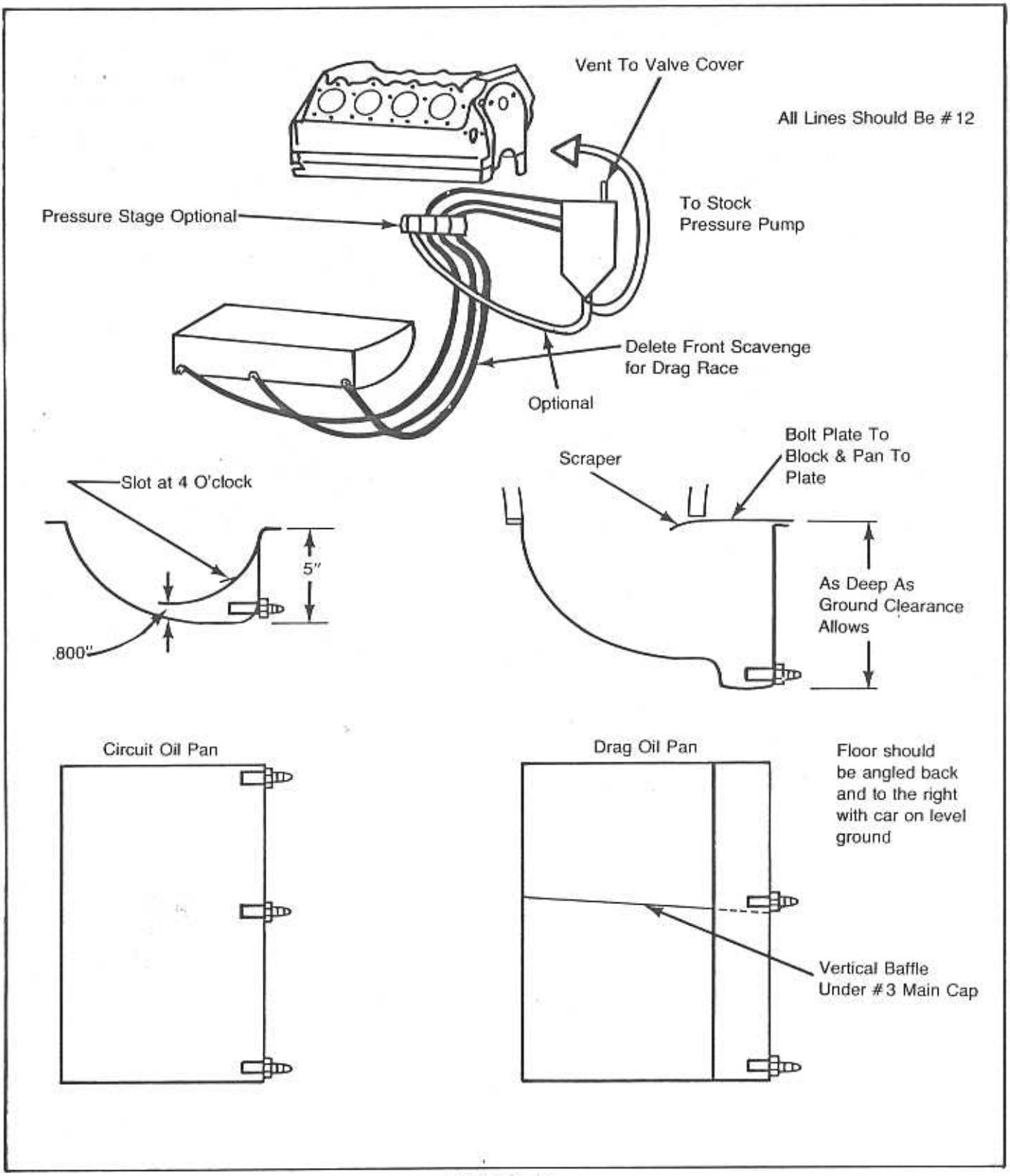


FIGURE 2-15

DRY SUMP OIL SYSTEM

B-RB engine blocks were stress-relieved in production or new. However a block will stress-relieve itself with use. It can be built into a race engine and run several hundred times. Then it is rebuilt into a better engine because the bores will be straighter, will move less with use. It is not usage alone that stress-relieves an engine block. It is thermal cycles. Heating up and cooling is the best cycle. The engine used in the around-town shopping car is better than the long-haul truck or police car which is never shut off.

b. Sonic Test

It is recommended that, if the block is to be used in a serious racing application, the block be "Magna-Checked". By this process the thickness of the cylinder bore walls can be checked non-destructively (sonically, i.e. using sound waves). This will indicate how good a block your particular piece is, or it will allow you to select the best block of several available if you have the option.

If you only have one block, the bore-wall thickness check really only serves as information. If you have several blocks to choose from, then the best engine will be the block with the least amount of core shift (bores with the same thickness all the way around) *or* the block with the core shift in the "major thrust" direction. The major thrust direction is to the passenger side of the cylinder bore as the block is installed in the car.

c. Honing

Before the honing operation is started, the cylinder walls should be inspected for cracks or pits and the bore checked for taper and roundness. The cylinder bore is most accurately measured by a dial bore gauge. For the actual honing operation, approximately .004" (.002" per side) of material should have been left after boring. (The size of the piston and the piston design are other factors determining the bore size and the piston-to-wall clearance.) The hone is used to gain desired surface finish on the cylinder walls and to bring cylinder wall diameter to its final dimension. The surface finish is stipulated by the choice of piston rings; but regardless of the actual finish, perfectly smooth or slightly rough, it should have a 45° cross-hatch pattern. (Moly rings, 10-15 micro inches; chrome or stainless steel, 15-25 micro inches. A 30 micro finish is fairly rough and is close to the hone finish on a production engine. A 5 micro finish is very smooth almost mirror finish.) After honing, the bores should be straight (no taper) within ± .0002 and round within ± .0002. For further specific details on honing, contact Sunnen in St. Louis, Missouri.

For serious all out race engines, the use of honing plates is recommended. They should be made of 1"-1½" thick steel plate. With a honing plate of this size, which is held on by cap screws, the screws should be torqued to the same specs as the standard head bolts.

The thickness of the honing plate and the installation torques are very important; but, of equal importance, and an item often overlooked, is the depth of thread engagement. The bolt should be turned all the way in and then backed off one turn for proper thread depth. This is approximately a 3/4" thread engagement. This same depth should be maintained when the head is installed if possible. It is best to check each bolt separately.

For the serious all-out race engine, honing plates are recommended. Honing plates from a 426 Hemi won't work on "B" and "RB" engines because the upper row of head bolts is located in the wrong place. Honing plates for the "B" and "RB" engines are available.

d. Boring and Milling Specifications

All the "B" and "RB" engine blocks can be over-bored .060" maximum. However, if the engine is to be used for high output racing purposes, the cylinder wall thickness should be checked to be sure that particular block doesn't have a bad case of core shift. See above Section b. The cylinder wall thickness should be the same all the way around or thicker on the major thrust side, i.e. passenger side, of the cylinder bore as installed in the car.

The majority of the early blocks without core shift can be over-bored .060. However, the newer blocks (1975-1978) should only be over-bored .030 max. because they are thinwall castings.

On any "B" or "RB" engine the following cylinder head and block milling specifications apply. For each .010" milled from the

cylinder head face, the intake manifold surface of the head should be milled .0123". Also for manifolds which seal to the block across the ends, the cylinder block's front and rear rails should be milled .017" for each .010" milled from the cylinder head or block deck.

The milling of the intake manifold gasket surface can be done on the intake manifold itself instead of the head. The ends of the manifold can also be milled instead of the front and rear rails of the block. Milling the manifold is not recommended in general because the manifold is no longer interchangeable from engine to engine, i.e. a milled manifold will only fit one particular block and head combination.

e. Further information on engine building and preparation is covered in Bulletin #18.

2. *Pistons and Rings*

The performance secret in pistons is light weight and a smooth, round top if it's a domed piston. The secret to performance in rings is to get them to seal to the piston *and* to the cylinder bore at wide-open throttle.

a. Pistons

For obvious reasons pistons are not interchangeable between the various B-RB engines. Factory pistons have the pin offset to reduce piston slap. By reversing the offset (reversing the piston) engine friction can be reduced. In engines equipped with power pak (domed) pistons this can be accomplished by installing pistons from the right bank in the left bank and vice versa. This means the notch in the edge of the piston top will now be towards the rear of the engine. With 2-Bbl., flat top pistons it is only necessary to reverse the piston on the rod and not necessary to swap from bank to bank. A piston to bore clearance of .0015"-.003" has proven to be adequate with *stock* type (cast) pistons.

The pistons for both the 383 and 440 style engines are readily available in standard and oversize configurations. Forged racing pistons are available for both engines from specialty manufacturers.

High compression pistons are also available from manufacturers such as TRW or Forge-True and should be of the general design of Figure 2-16.

It is possible to make the dome too high and too sharp which can have an adverse effect on the output of the engine. If this is the case, then some of the blocking dome should be removed and some of the steep angles and sharp edges should be rounded over.

The Direct Connection program carries several B-RB high compression forged racing pistons referred to as 11.5 to 1. These pistons feature a dome design similar to the 11.0 to 1 piston. Refer to Figure 2-16. These pistons could also result in a 12.0 or 12.5 to 1 actual compression ratio if they are used in conjunction with milled heads or a decked block.

11.5:1 Piston with pin (pressed-in-rod)			
383 Engine	PN	P3690827	Std. Size
		P3690828	.030 Oversize
		P3690829	.060 Oversize
400 Engine	PN	P3690830	Std. Size
		P3690831	.030 Oversize
		P3690832	.060 Oversize
440 Engine	PN	P3690833	Std. Size
		P3690834	.030 Oversize
		P3690835	.060 Oversize

Because of gasoline limitations, compression ratios should not exceed 12.5:1 for competition; 10.5-11.0:1 for general off-highway use — unless you have access to high quality premium fuel (103 octane). Bulletin #43.

Several of the B-RB engines' bore diameters overlap in actual size. For example the 383 and the 426 wedge have the same 4.25" bore; a .020" oversize 440 and a stock bore 400 are both 4.34". To a certain extent swapping pistons in these examples is possible, but the 383 and 400 'B' engines have a .100" lower piston height than the raised block (RB) engines.

1968	383	1.93"
1972	400	1.83"
1968	440	2.03"
1970-71	440-6 Bbl.	2.06"
1972	440	1.93"

The above selections are representative of those available. The piston height listed is the distance from the piston pin center to the top of piston. Don't assume that pistons of the same bore can be swapped without checking the effects on compression ratio, valve clearance, piston to head clearance, engine balance, etc.

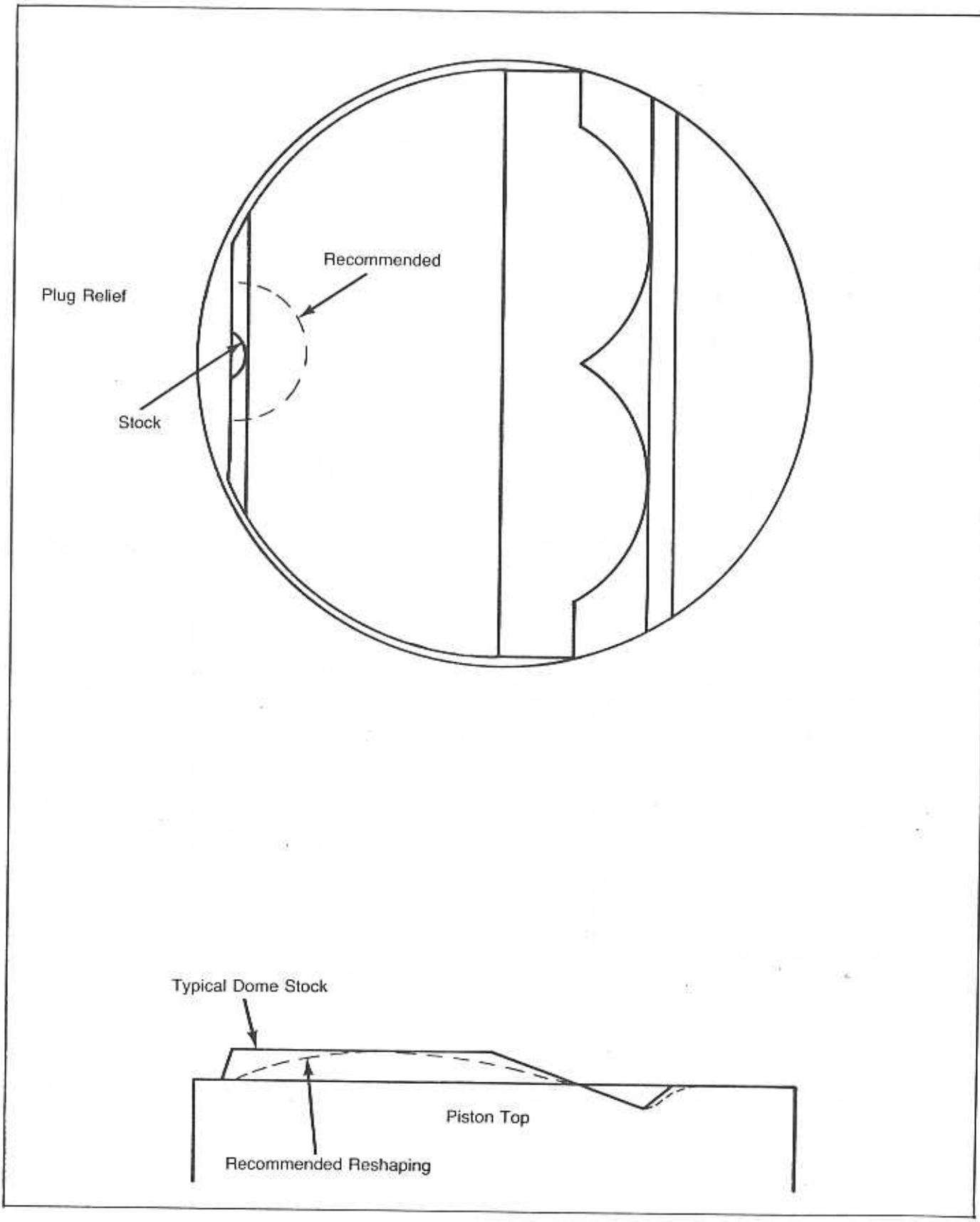


FIGURE 2-16

RACE PISTON RESHAPING

b. Rings

There are several types of race piston rings. The stock ring is a 5/64 straight ring. There are also 1/16 straight, .043 and .031 both straight and Dykes, Headland and gas ports. The .031 Dykes ring is usually the best choice for power and long life, especially in high speed engines. The gas port .043 setup *might* make more power but wears out quite fast. The Headland offers good sealing and therefore power in lower speed engines (7500 rpm or less) but is harder to install properly. The 1/16 straight ring in most cases offers the best of all worlds, especially for bracket racing or the amateur engine builder.

Side clearance of the ring in the piston groove is very important and can be checked with feeler gauge (.0005" to .0015"). Be sure that a used piston's groove isn't worn in the shape of a wedge. It doesn't do any good to seal the ring to the cylinder wall if it isn't sealed to the piston groove.

Do not install rings that were made for a larger bore. A special .005 oversize ring is best for lowering the ring end gap. In stock-type rings, low tension is important to lowering engine friction and increasing the engine's output. When you are gapping the rings in the bore, light-check them for being oval. Oval rings in a round bore will only seal in a couple of places, and therefore the engine won't make any power. Oval rings are the result of installing rings that are .020" or more larger than the bore.

3. *Connecting Rods*

Do not increase connecting rod side clearance beyond the specified .017" (the acceptable range is .008" to .017"). Excessive side clearance increases the oil demand of the engine as a result of excessive oil leakage past the rods. Increasing oil demand reduces the oil available for lubrication and cooling at high engine speeds.

The B-RB engines use two different length rods. For racing or other high performance applications, the magna-fluxed, double shot peened rods with the high strength bolts and nuts, PN P3690644 for "B", P3690649 for "RB" engines, are recommended. If these rods are not used, the high strength bolts and nuts, P4120068 are an absolute must.

Also available for the "RB" engine only and the best (strongest) "RB" rod, PN P2531589 is the one made from the Hemi forging on the 6.76" center distance with a 1.09" pressed pin and 7/16 high strength bolts and nuts. This rod also requires the crank to be rebalanced. All B-RB engine rods use a pressed pin. They can be converted to the floating pin rods by bushing the small end of the rod and adding lock rings to the piston. Rods that have full floating pins and are to be used in a racing application should have the small rod end drilled with a small hole for increased piston pin oiling. (See Figure 2-17).

Today the H.P. "B" rod is no longer available. The "RB" rod, P3690649 is now made of 8640 material which makes it the best "RB" rod. It gets its strength from the better material without increasing its weight and the lightweight allows the engine to perform better.

4. *Crankshaft*

The B and RB crankshafts should not be grooved because it weakens the crank. To provide for extra oil to the rod bearings, the grooved main bearing shells (use D.C. bearing set) should be used in the B engine. The Hemi main bearings which are fully grooved should be used in the RB engine.

For all-out competition it is recommended that raised block engines be equipped with the 413/426 Ramcharger super stock crankshaft PN 2406240. This is a forged steel unit, flame hardened, and is far superior to the standard crankshaft. The 440-6 bbl. crankshaft PN3512036 is also a superior quality crankshaft and should be used if the Ramcharger unit is not available.

If these premium cranks are not available, any of the B-RB forged cranks should be adequate. B-RB forged cranks are very good pieces.

The cast crankshafts used in the 383-2 bbl., the '72-78 400, and the '74-78 440 engines require a specially balanced vibration damper and a specially balanced torque converter or flywheel. If the cast crank is used, the specially balanced vibration damper and torque converter (flywheel) must also be used. If the cast crank is replaced in an engine with a forged crank, then the damper and torque converter (flywheel) will also have to be replaced. Use *only* cast crank dampers, flywheels, and converters *on* cast cranks and *only* forged crank dampers, flywheels, and converters *on* forged cranks.

It is not necessary to balance an engine using production parts (crankshafts, rods, pistons)

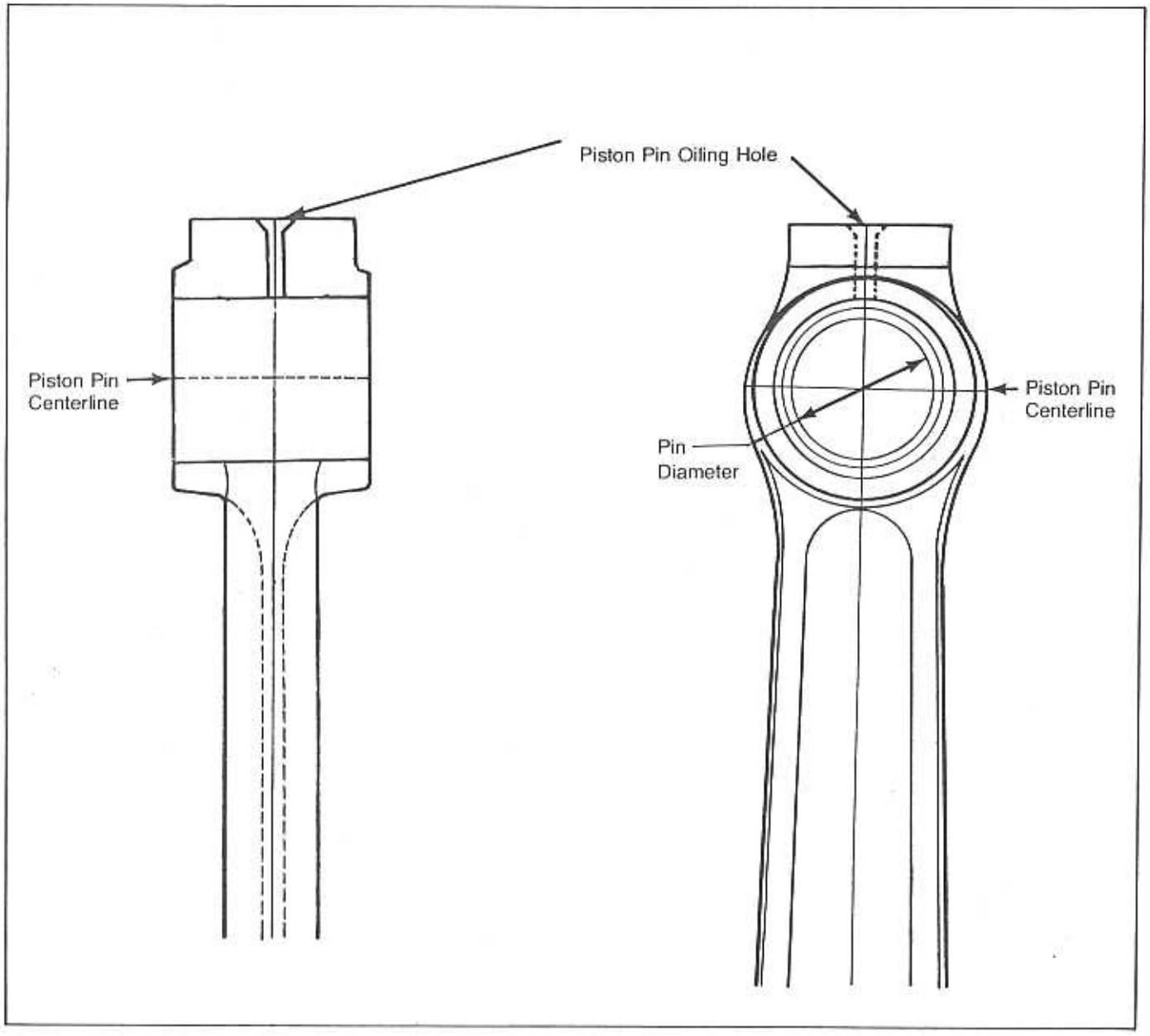


FIGURE 2-17

The generally held opinion on rod ratio (rod length divided by stroke) is that 1.80 to 1.85 is best for drag racing engines. The 383's rod ratio is 1.89 and the 440 is 1.80. Changing the rod ratio is expensive and results in only very small gains which will only be found by professionals.

for drag-strip use. Production balance tolerances are more than adequate. A race engine should be balanced.

The cast crank production engines are externally balanced. They can be internally balanced by using "Mallory" metal. This operation is very difficult and only a few shops can perform it. Mallory Metal PN P3690882. (It is expensive and *very* heavy.) See Bulletins #7 & 19 for more external balance information.

If lightweight pistons and pins are used with stock or aluminum rods, the assembly is lighter and the crank must be rebalanced. However instead of adding "Mallory" metal, metal will need to be removed from the crank. This can be done by knife-edging the crank or by reducing the diameter of the counter weights. This can't be done for small changes in piston weight such as a few grams. For competitive Super Stock racing the production piston that weighed around 800 grams is replaced with a lightweight piston of 500 grams and the pin weight is cut in half. With this type of weight reduction, a lot of material must be removed to balance the assembly. In these conditions is when the crank can be machined down. We recommend that you take your crank to a professional for this type operation.

5. *Oil Pump Drive and Oiling*

The oiling system and oil pump drive (intermediate shaft) are part of the short block and should be installed and checked for fit and proper operation while the engine is on the engine stand. Specific recommendations are covered in an earlier section.

6. *Lifter Bore Sleeving*

The tappets of the B-RB-Hemi engines can be bushed (sleeved) for all-out racing purposes. This can be done to all tappet bores except the first two from the front of the engine on the right bank (i.e. intake and exhaust tappet bores for cylinder #2). See Figure 2-18. These must be left standard or the oil to the main bearings will be restricted. The resulting tappet clearance in the bushing should be at least .0015". If the first two tappet bores are sleeved, the resulting main oil feed restriction will cause the engine to spin bearings and fail.

7. *Engine Break-In*

The break-in of the engine is done after the engine has been final assembled and checked and possibly should go at the end of this bulletin. However the type of break-in used is a function of the short block and the rings and hone finish used. There are many engine building steps that have been skipped but are covered in detail in Bulletin #18. Pay particular attention to the tips on engine starting and final checkout.

a. Engine Break-In with Rough Bore Finish

When chrome flashed rings are used, the cylinder bore finish should be 30-40 micro inches. This is fairly rough compared to production bore finish of 20-30 micro inches. Use a medium stone and clean it frequently to avoid scratching the bores. The cross hatch angle should be 45°-60° (included angle).

The proper break-in procedure with the above bore finish is:

Number Shift Cycles	Shift Speed
10 @ part throttle	3500
5 @ part throttle	5000
Cool down to dead cold	
3 @ part throttle	Max. RPM less 750
3 @ open throttle	Max. RPM less 250
Cool down. Race.	

b. Engine Break-In with Smooth Bore Finish

With the new smooth hone finish (AN501 Sunnen stone-wet) on the cylinder walls used typically with moly rings the following procedure should be used for engine break-in:

Each run should consist of short interval 1/2 to 2/3 load bursts.

5-6 runs total beginning at 4500 rpm.

Increasing the engine speed each time approximately 500 rpm.

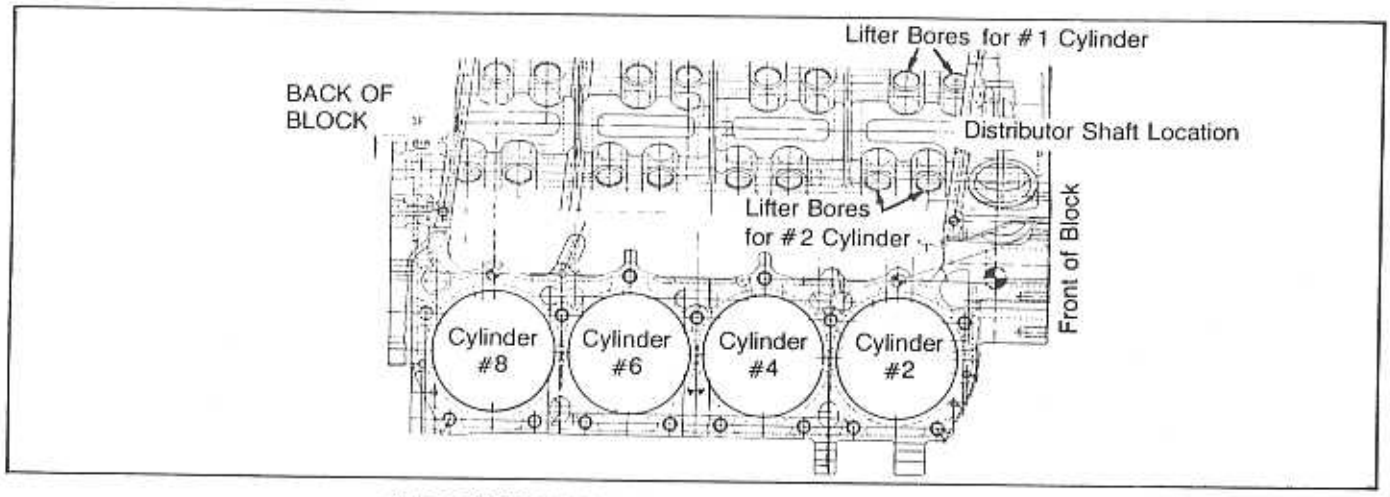
Final run of break-in cycle — Max power rpm.

c. Blow-By

Blow-by is the loss of compression pressure and the resulting increased oil consumption and smoking. This is very bad and should be minimized. It is a good indication that there is room for improvement in the engine's output and power. A measured blow-by of 1.5 to 4 cfm is a good engine. If it has 10 or more, it should have new rings and be rehoned.

H. Cylinder Heads

The cylinder heads on the "B-RB" engine are very straight forward and require very little special or



B-RB-HEMI VALLY CHAMBER VIEW OF BLOCK

FIGURE 2-18

custom machining or other items. Because of the five head bolts around each cylinder bore, the head is very rigid and very few head gasket problems are ever encountered. There are several special considerations which we will cover in the next few sections.

From a performance standpoint, cylinder heads are a major contributing factor to the engine's horsepower output. The most important aspects are the valve job and the port shape (flow).

1. *Stage IV Head*

   The new B-RB engine cylinder head, called the Stage IV is a revised 'B' engine late model passenger car cylinder head casting. It is primarily designed for bracket racing and is 100 percent interchangeable with the standard B-RB heads produced in the last fifteen years. It gets its name *not* because it looks as radically different as did the Stage I, II, III castings, but because it is a casting specifically designed for high performance applications. Unlike the 'A' engine W2 which is perhaps the best wedge head casting in existence, the new Stage IV does not have oval intake ports or D-shaped exhaust ports and doesn't require anything special for valve gear.

   a. Specific Description

      The Stage IV head uses the production cast iron intake manifolds or any of the Holley, Weiand, or STR aluminum versions. It also will use the production cast iron exhaust manifolds or any of the currently available B-RB headers. The exhaust flange is identical to the production heads. There is a heat cross-over passage in the Stage IV. The rocker stands or pedestals are cast in and there are six valve cover attaching bolts like all 65-78 B-RB production heads. They use stock valve covers. The standard valve sizes —2.08" intake 1.74" exhaust are used. A Stock valve job is done not a "competition" one. The spark plugs are stock. They are *not* "angle plug." The big, open-type combustion chamber similar to the '68-78 heads is used with 86+ cc. in its unmilled configuration. The stock-production pushrods, rocker arms (both hydraulic and mechanical), rocker shafts and valve springs (single) can be used. Any of the production single valve springs including the 440-6 bbl or Direct Connection P3690933 will work without modification. There are two valve seals, one short and one long, to be used. The short seal goes with the large diameter valve guide. The cylinder head, intake manifold, exhaust manifold, and valve cover gaskets are the same as stock. Viton valve seals P4120492 are recommended.

   b. Changes

      Although the Stage IV is a 100 percent interchangeable and doesn't appear to be any different from a production head casting, it is a special casting with several changes. The enlarged intake and exhaust ports have a revised shape. They are streamlined and bigger by approximately .060"-.100" height and width. The stock-production intake port has a sizeable "dogleg" in it approximately 3/4" in from the intake manifold face. The new Stage IV has this dogleg almost completely removed. There is also a Direct Connection

loggo cast into the top of the head and the new casting number is 3614476. The D.C. Stage IV valve cover decal is P4120473.

c. Installation

It was originally intended that the Stage IV head would bolt-on to all B-RB engines without any modifications. However, the large intake port will now interfere with the intake pushrods. This occurs at the bottom of the head, cylinder head gasket side, and the intake pushrod clearance will have to be ground.

For the more highly modified engine that uses dual valve springs, the inner spring seat will have to be cut especially on the intakes which have the large diameter guide. Also keep in mind that race engines with high lift cams, should have the guides shortened to the appropriate guide to keeper clearance for your camshaft's valve lift.

d. Design Improvements

Flowing the dead-stock State IV by inserting stock valves, the unmodified intake shows a nice improvement over the best of the production castings while the exhaust improvement is really sizeable. Neither port "stalls." Slightly modifying intake throat area results in a big improvement. Comparing the new Stage IV 'B' engine head to the 'A' engine W2 in air flow both in Super Modified configuration shows that the IV is superior to the W2 at low lifts and yet good at high lifts also. From a porting standpoint, the ports weren't made bigger by making the walls thinner. More metal was added around the new, bigger ports so that in ported configuration they can get even bigger. The spot for caution is the valve gear oiling hole between the two intake ports.

e. Performance

In general, the more good pieces such as headers, camshaft, carburetion that are part of the engine package the larger the performance gain. Also as noted above in airflow, the more modifications that are done to the head before it is installed, the bigger the gain is in engine output.

2. *Head Swapping*

All B-RB cylinder heads are interchangeable which makes head swapping easy. The old '62-64 max wedge stage cylinder heads are not recommended for swapping because there are no manifolds available for the B engines and only the two-four barrel cross ram is easily available for the RB engines. The best of the B-RB cylinder heads are the '67 440 head and the '68-70 383-440 four barrel head. The '67 440 head PN 2806762 is still available and the most popular because it has the smaller combustion chamber. Today this smaller chamber may be a disadvantage because it increases the compression ratio and the pump gas available isn't capable of supporting the higher C.R. This can be solved by using a thicker head gasket (refer to later section on C.R.). The only physical problem with the '67 head occurs if it is used on the '68-69 383. The '68-69 383 has a positive (above block) deck height which does not have enough piston-to-head clearance to allow the use of the small chamber heads. The deck height would have to be zero to below the block to use these small chamber heads.

NOTE: The thick gasket available from D.C. will also solve the '68-69 393's problem and allow the '67 (or any small chamber) head to be used.

The Stage IV will interchange with any of the other B-RB heads. It has the large chamber similar to the '68-78 production heads. It uses the 2.08 and 1.74 valves and can use the production valve train. All these pieces from '68 or newer heads will fit the Stage IV. In all cases pushrod clearance must be ground at the bottom of the intake runner, for the intake pushrods.

3. *Oversize Valves*

The standard valve sizes for the B and RB engine are 2.08" diameter intake and 1.74" diameter exhaust. There are commonly available oversize exhaust valves (1.88) which can be readily made to fit the standard B engine head. Oversize exhaust valves (1.88") in the B engine head result in a power loss and are therefore not recommended. The Stage I, II or III heads should still use the 1.88 exhaust valves since they were designed to use them.

The older heads, pre '68, which used the 1.60" exhaust valve will respond with a large increase in horsepower if the 1.74 exhaust valves PN P3690709 are installed. This exhaust valve has three lock grooves. The high performance 2.08" Intake valve P3690708 has only a single lock groove.

The 1.88" exhaust valves require a bore notch because they are so large. However, big is not always best and the 1.88 is not recommended for use in the standard heads. D.C. does carry a replacement head P4120549 for the 62-64 max wedges with a 1.88 exhaust valve but it is specifically for use in these cars. Serves as a piece to wear out because of the expense of the Stage I, II, III heads.

The first oversize valve modification that should be considered for the standard production or Stage IV heads which have the 2.08 Intake and 1.74 exhaust valves is to change to a larger intake valve. A 2.14" (P4007942) single lock groove, nail head design is recommended. The next step is to install a larger 1.81" exhaust valve (P4120579) which is also a single lock groove. The 1.81" exhaust valve is the best size for the 'B'-"RB" cylinder heads. These two oversize valves will fit in the B-RB engines with cylinder bores of 4.32" or larger without a bore notch.

4. *Valve Grinding*

It is very important that the valve seat specifications shown in the illustration be carefully followed. If valve face and seat run-out are less than .0015", it would be best to leave the seats alone until 50 to 75 hard runs have been made. Then, touch up valves and seats according to the specs. It must be remembered that the further the valve seats sink into the ports, the less horsepower the engine will produce. Never sink valves to equalize combustion chamber volume. Do not grind the valves excessively and do not narrow the valve seats below specs. See Figure 2-19.

For NHRA stock or super stock valve job, the following rules apply:

The valve must be faced at factory specification angle, and the seat angle must also meet factory specs. The valve seat may be narrowed from the top with any angle less than the seat angle, but not to exceed 1/4" larger than the valve head (see diagram). The seat may be narrowed from the bottom with up to a 70° angle. The maximum width for valve seat and bottom cut may not exceed 1/4" when measured together (top of seat to bottom of cut). See Figure 2-20.

The valve seat must be enlarged if the oversize valves referred to in the previous section are used.

5. *Bracket Valve Job*

It can be noted in the previous section that the class racer (Stock and Super Stock) has very specific rules to follow (1/4" from seat) in his valve job. The Super Modified-Econo class head has more latitude (1" from the seat). In bracket racing there are no rules regarding valve work. We recommend a valve job halfway between these two unless ported heads are used. It consists of backcutting the production valves and opening up the throat area.

This doesn't directly apply with the oversize valves mentioned previously. These valves are nailhead designs which don't need to be backcut. To enlarge the valve seat for the larger valve, the throat area will also have to be enlarged. To get the most from the oversized valve, the throat should be enlarged as much as the valve is (See "Porting" section).

6. *Spring Seat & Valve Guide Cutting*

The valve guide and spring seat do not have to be cut with camshafts such as the SSH-44 or D.C. 509 which have less than .525" lift.

These special operations become necessary with the high lift race camshafts.

If dual or triple valve springs, such as the Purple Stripe PN P2806077 or the Battleship PN P3462887 are used, then the inner spring seat should be milled *flush* with the existing outer spring seat.

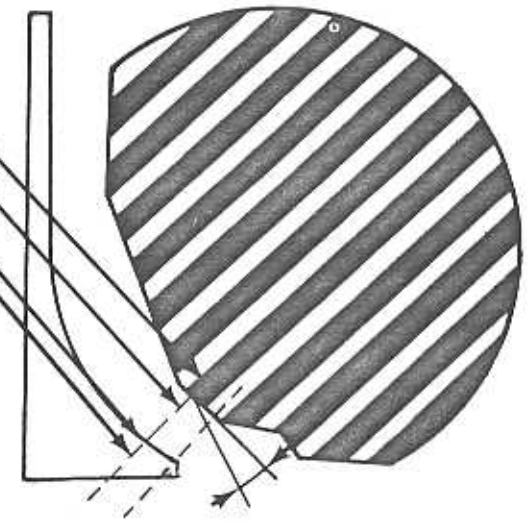
With the use of high lift camshafts, the clearance between the top of the valve guide and the bottom of the retainer that is to be used should be measured. This can be done by using checking springs. The minimum clearance of the valve spring retainer to the valve guide at the maximum cam lift should be .060". If it is less than this, then the valve guide should be cut down the appropriate amount. See Bulletin #44 for more details.

7. *Porting*

Use porting template kit P4120437 for porting the standard head or the Stage IV cylinder head. The most important part of the port is the bowl area between the valve seat and the radius on the port floor. Blending the machined bottom cut into the cast surface gives a large increase in port flow.

If you use the porting templates, do not remove more metal than is required to fit the templates. Excess metal removed, especially on the floor, can cause very poor flow.

Ideal Valve Face and Seat Widths
(Seat Should Center As Near
As Possible On Valve Face):



Seat Widths	
Exhaust	.05 ± .01
Intake	.07 ± .01
Face Widths	
Intake	.09 ± .01
Exhaust	.10 ± .01

Seat Reconditioning

1. Grind Valve Faces and Seats to 45°
   (Runout not to exceed .002").
2. Bottom Dress with 70° Stone
3. Top Dress with 0° Stone For Light Reconditioning.

FIGURE 2-19

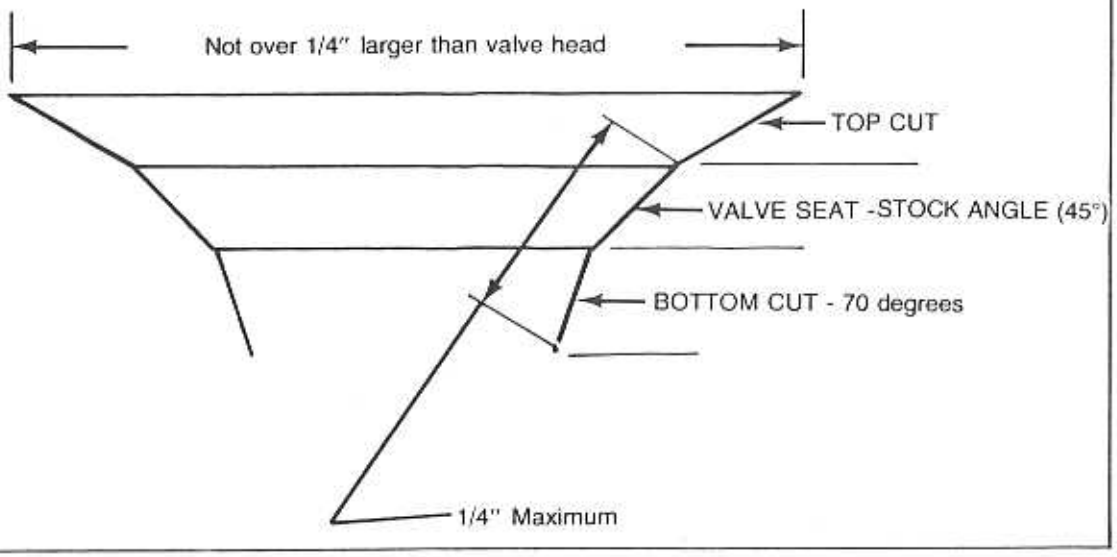


FIGURE 2-20

For all-out modified racing, a professional porting service should be contacted.

8. *Installed Spring Height*

The production 'B' engine and Stage IV installed height is 1.86". This installed height is used by all 'B' "RB" and Hemi engines.

The 'B' engine installed height spring usage recommendations are as follows:

up to .510 Valve Lift	P3690933
.510 to .620 Valve Lift	P2806077
.620 to .700 Valve Lift	P3462877
Over .700 Valve Lift	Crower Red or Orange

There are several "tricks" to 'B' engine springs such as the 2.00" installed height and the "triples".

On most used B-RB heads, the installed height is much closer to 1.900". This can be decreased by using spring shims or increased by changing the spring retainers. If the installed height is increased to 1.950" to 2.000" commonly referred to as 2" valve gear set up, the "trick" 2" springs can be used. These springs are the D.C. dual P2946353 and the Chrysler Triple P4007536. The "Triple" is recommended for high lift (over .700") drag engines. The other spring would be best for high lift cams on oval track cars. These springs have almost as much load as the Crower Red Stripe springs and are much cheaper and easier to obtain. On the B engines, especially the RB engines these springs at the *2 inch* installed height will work as well as the Crower. This is not true in the Hemi.

9. *Cylinder Head Hardware*

All 'B' engine heads are attached by the same set of 7/16" head bolts. D.C. package P4120472 includes one complete set. If a washer is to be used to adjust the bolt's thread engagement in the block, a 7/16" *hardened* washer should be used. D.C. package P4120457 includes twenty.

Dual purpose engines should use valve seals. The valve stem size is the major determining factor and all B-RB valves along with the oversize valves are 3/8 stem. With a single spring and damper spring like P3690933 use the heavy duty Viton seals P4120492. This will work with cams up to .510" lift. For cams with more lift than this (over .520") which would basically make poor dual purpose machines, a dual spring would be required by the cams. This dual spring means that the good Viton seals can't be used because there is not enough room. The only valve seal that will work with dual springs is the PC seal P3690963. The PC seal is not nearly as durable as the Viton seals. With new bronzewall valve guides the PC seal will be acceptable.

10. *Valve Guides*

The valve guide in the B-RB heads is machined into the cast iron. In used cylinder heads, the guides may be worn. If this is the case, we would recommend using bronzewall guides. They are a little more expensive but they are well worth the investment.

J. Camshafts

The camshaft is selected for its performance characteristics. This cam selection affects many other parts especially the valve springs. The directly related items will be covered in this section and rest of the parts will be covered in the Valve Gear section immediately following.

1. *Hydraulic Cams*

The first choice for a moderate performance improvement in the 1958-67 B-RB engines and the newer 383-400 2-Bbl. engines would be the "Road Runner" cam, PN 3512907. This cam was used in the Road Runner 383's, the 1967-70, 375 HP 440, the 1971, 370 HP 440, the 1971, 300 HP 383, the 1972-76, 400-4 Bbl. H.P., the 1972-76 440-4 Bbl. H.P. and all 1968-70, 335 HP 383's. With 268-284° duration and .450" lift, this cam is a very versatile performer in any B-RB engine. This cam has been superseded by PN 4071002 which is the same profile.

The new Hemi profile cam, PN P3690214 is the next step in high performance hydraulic cams for the "B" engine family. With a duration of 284° and .470" lift, this cam has the radical idle characteristics to go with its increased performance. Although they are not required, the 440-6 Bbl. valve springs, PN P3690933 are recommended for use with the Hemi profile cam.

The next step in high performance hydraulic cam, P4120235 is the .484" lift D.C. profile with 284° duration. This is a cam and tappet package. It is considered to be the last step (biggest) cam for a dual purpose engine, especially with an automatic transmission.

High performance race cars with 4.10 or deeper rear axle ratio, the biggest of the hydraulic cams, D.C. 509, PN P4120237 can be used. It

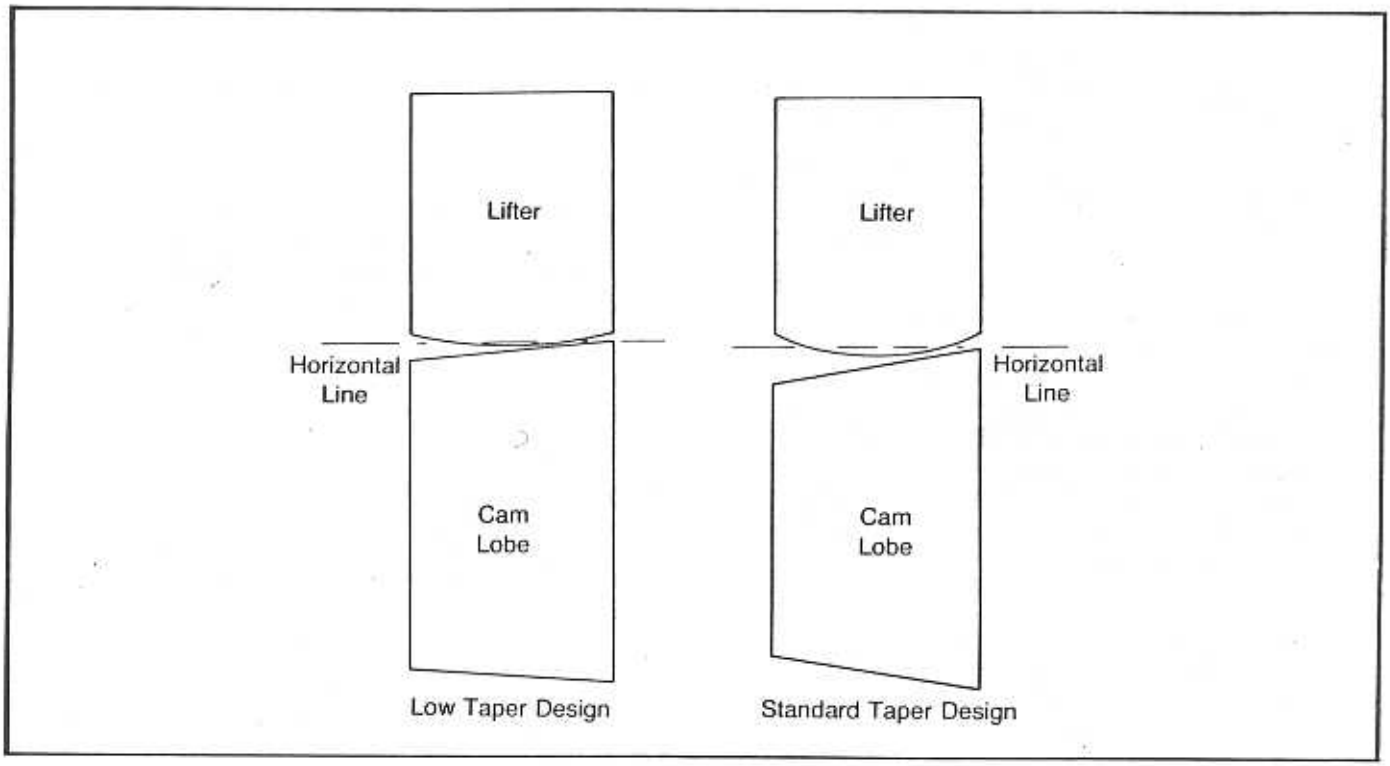


FIGURE 2-21

has .509" lift and a duration of 292°. It would be the last step for the dual purpose manual transmission cars and a higher stall converter is recommended with the automatic. The 292° makes this a very long duration *hydraulic* and therefore will idle poorly and reduce driveability. It is recommended that springs, PN P3690933 be used with this camshaft. This cam will make more horsepower than the other hydraulic camshafts mentioned. It is also the biggest hydraulic camshaft recommended.

The 440-6 Bbl. camshaft has 268-284° duration and is a low-taper design. A low-taper camshaft requires the lifter face to be ground on a much larger radius resulting in a flatter face on the lifter. See Figure 2-21. Because of this low-taper design feature of the 440-6 Bbl. cams, they require special hydraulic lifters, PN 3420039.

NOTE: Camshafts with a duration greater than 286° will require valve clearance pockets in the top of the pistons. This does not apply to the low compression ratio engines 8.5 to 1 and less, built for 1972-78. These engines can install the 292°, .509" hydraulic without valve notches (stock head and pistons). See Figure 2-22. It is *very* important that a new camshaft be installed with new lifters and be liberally coated with special cam break-in lubricant called Lubrizol — 4 oz. can, PN P3512626.

Previously Direct Connection sold a 286° cam, P3412073 and a 292° degree cam, P3690812. These cams have been cancelled and replaced by the newer D.C. profiles because these newer profiles are specifically designed for "bracket" racing and therefore offer more performance for the same cam lift.

Hyd. Cam Testing

Direct Connection has spent a lot of time in the lab and at the track TESTING AND DEVELOPING NEW CAMSHAFTS. A wide range of prototype cams that would be suited for bracket racers and street/strip enthusiasts were installed in one of Chrysler's own test cars. The test car, driver, strip conditions and a 108° cam centerline remained the constants. The car itself was a 400 cubic inch Duster ("B" engined "A" body) which has an 8.5 compression ratio (stock pistons), 4-barrel carb, headers, Stage IV heads (with stock valve sizes) and a D.C. chrome box ignition. It weighs in at 3,000 lbs. (without driver), has an A-727 torque-flite, 8¼ sure grip axle with 4.30 ratio and 9" slicks. The following are the results for hydraulic cams.

CAM	PART NUMBER	E.T.	MPH
Stock Hydraulic	P3512907	12.35	110.27
Street Hemi	P3690214	12.17	112.60
D.C. 484	P4120235	11.91	115.30
D.C. 509	P4120237	11.82	116.61

The stock Hydraulic cam can use stock red valve springs with dampers but the others must use D.C. springs P3690933 in "B" engines. We recommend single springs with the damper design which enables use of Viton valve seals for dual-purpose use. These seals (P4120492) are advised because they feature an umbrella shape for best oil con-temperature resistance. temperature resistance.

The new Direct Connection hydraulic cams were designed specifically for bracket racing using the latest performance computer design programs. We also ran competitive tests using other cam manufacturers' profiles with similar lifts and durations. The D.C. designs proved to be faster and quicker. Talking numbers, the D.C. 484 and D.C. 509 cams averaged .15 seconds quicker and 1.50 mph faster than their respective competitive designs.

2. *Mechanical Cams*

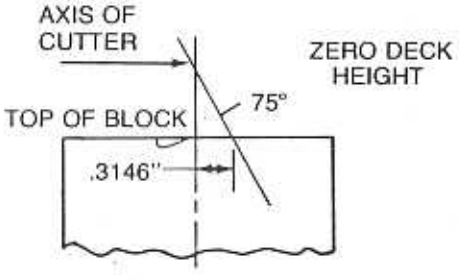
The last of the high performance mechanical camshafts were used in the 1962-63-64 max. wedge, 413-426 engines. The 1964, 415 HP 426 Stage III used mechanical cam, PN P3690816 with a 300-308° duration and a .520" lift. This was a good choice for a first step mechanical cam for a serious bracket racer. General mech. layout Fig. 2-23.

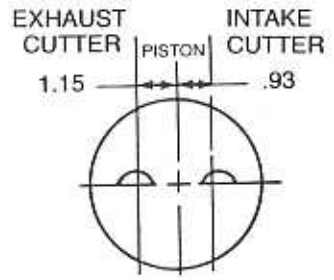
The 300-308 camshaft uses valve lash setting of .028" intake and .032" exhaust. The Hemi green stripe dual valve springs, PN P2806077 should be installed. (NOTE: This spring used to have a purple stripe.) The installed height should be 1.86 inches.

The next step in mechanical cams is new factory engineered D.C. profile, P4120659 with .528" lift. It is a 284° design with 60 degrees of overlap. It can be used with either automatic or manual transmissions. This is a cam and lifter package.

The D.C. profile P4120659 also installs at a valve spring installed height of 1.86" and uses valve spring P2806077. The D.C. profile has less duration (284 vs. 300) and slightly more lift than the early Stage III design. This is possible because the D.C. profile uses new design techniques that weren't available in '64 plus the cam was specifically chosen for bracket racing. The less duration also means that the D.C. profile has more flexibility and should have better driveability.

Eventually the older P3690816 cam discussed above was superseded by the newer profile, P4120659 which offers more performance,





NOTE: BE SURE THAT INTAKE & EXHAUST NOTCHES ARE PAIRED CORRECTLY ON EACH PISTON. DO NOT CUT NOTCHES DEEPER THAN NECESSARY TO OBTAIN CORRECT CLEARANCE AS THIS WILL REDUCE COMPRESSION RATIO. ASSEMBLE ALL PISTONS WITH NOTCH TOWARDS REAR ENGINE. MINIMUM PISTON TO VALVE CLEARANCE .090 — .100

Valve Size	Cutter Size
2.14	2.24
2.08	2.18
1.88	1.98
1.81	1.91
1.74	1.84
1.60	1.70

FIGURE 2-22

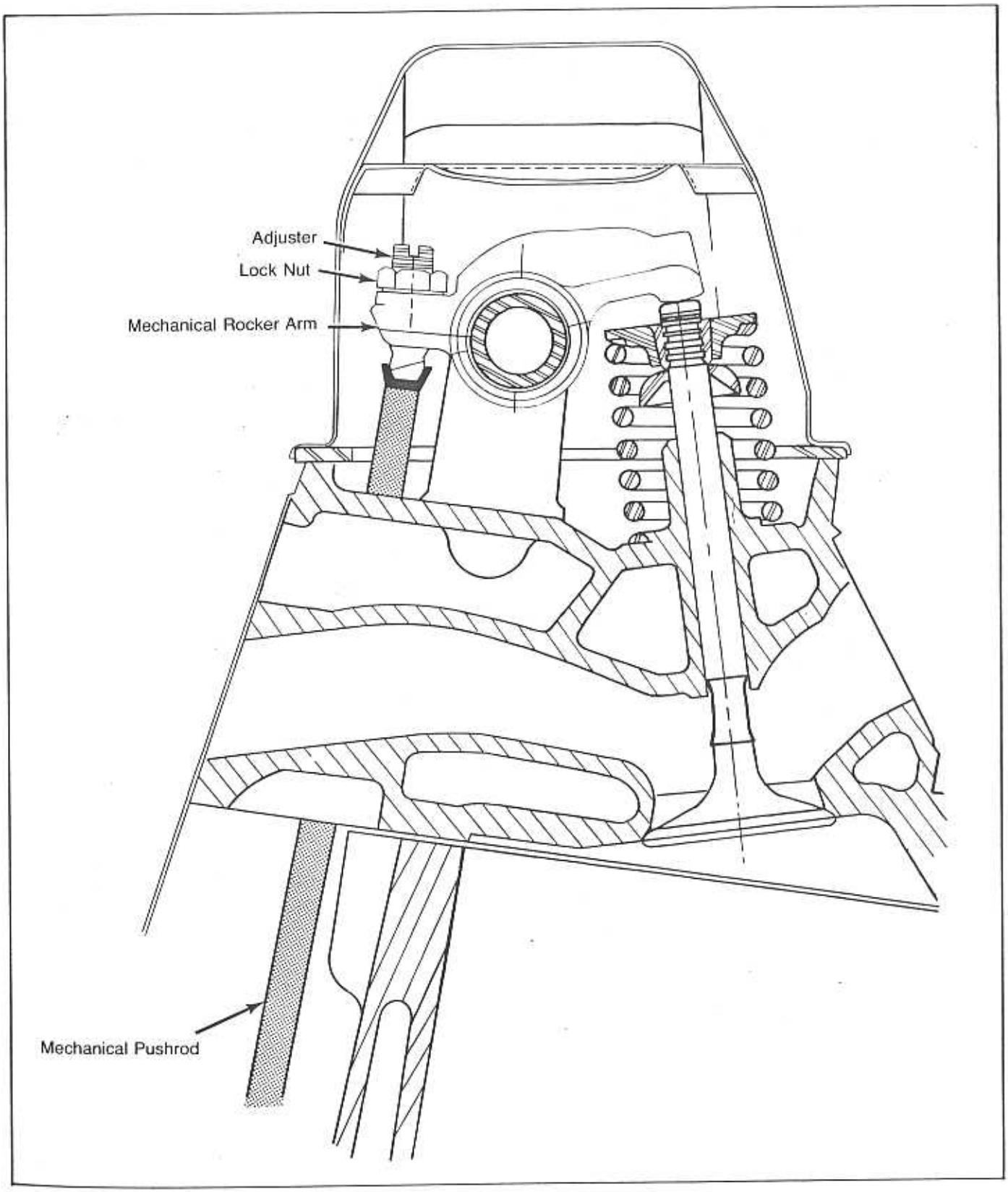


FIGURE 2-23

(B ENGINE) GENERAL MECHANICAL VALVE GEAR

Factory engineered mechanical cam and tappet package P4120661 is designed for bracket race use with a manual transmission or an automatic with a high stall converter (T-A 3800). It has 296° of duration and a .557" lift.

The largest of the new D.C. mechanical cams has 312° duration and .590" lift and is carried as a cam and tappet package, P4120663. It is designed for the all-out bracket race car with a manual transmission or an automatic with a race converter. It is the largest of the standard flat tappet profiles.

The next larger profiles use a mushroom lifter or rollers. All these new mechanical cams (3) use the green stripe valve spring, P2806077.

One of the newer Chrysler camshaft designs is called the "Mini Express", PN P3690588 The "Mini" produces more horsepower than *any* other flat tappet cam we have tested. Because of the radical nature of the "Mini", .100 oversize mushroom lifters are *required*. The bottom side of the lifter bore must be back-spotfaced. See Fig. 2-24. The "Mini" has a 106-107° centerline. With the higher lift of the "Mini", Chrysler's "Battleship" valve springs, PN P3462887 are required. The "Mini" is sold as a kit which includes the lifters, PN P3690588. The mushroom lifters are sold separately under PN P3690137.

For the maximum in horsepower for the all-out drag race car, one of the big roller camshafts will be required. For the all-out, max-power, unlimited carburetion engine, the Cam Dynamics R-286-500-8, PN P4007279 is the best choice. This cam is recommended for all 383, 400, 426 and 440-4 Bbl, 6-Bbl and 8-Bbl, Super Stock packages and obviously engines more highly modified than a Super Stocker. All these big roller camshafts require the "Battleship" valve spring, PN P3462887 or the Chrysler triple, P4007536. Also recommended for use with these cams are hardened keepers, 3/8 stem lash caps, PN P3690763 and Apollo titanium retainers, PN P4007245 (Dual Springs only) and aluminum-bronze distributor drive gear. Also see later valve gear section for information on 10 degree keepers and retainers, and triple springs for use with these cams.

Mechanical Cam Testing

Upon completion of the Purple Shaft hydraulic cam testing covered earlier, Direct Connection focused attention on testing the NEW MECHANICAL CAM DESIGNS. Three mechanical cam designs were installed in our 400 cubic inch "B" engined Duster bracket test car. The test cars' engine features an 8.5 compression ratio (stock pistons), D.C. headers, Stage IV heads, 850 cfm 4bbl D.C. carb and a D.C. chrome box ignition P4120534. Other equipment included a P4130410 A727 torqueflite and 4.30, 8¼ rear-end with 10½ slicks weighing in at 3200 lbs. (less driver). Here are results for the "B" engine mechanicals and baseline hydraulic cam:

Cam Part No.	Duration	Lift	Center-line	E.T.	MPH
P4120237 Hydr. (Baseline)	292	.509	108	11.77	114.89
P4120659 Mech.	284	.529	112	11.69	115.90
P4120661 Mech.	296	.557	110	11.55	117.05
P4120663 Mech.	312	.590	106	11.45	118.00

Each cam was *installed* at a cam centerline 2° less than the centerline listed on the chart, i.e., the .590 lift cam ground on 106 centers was installed at a 104 centerline. The valve springs P2806077 remained the same in all tests.

Not all lifters will work with all cam designs. A roller lifter will not function properly on any except a roller cam design. There are also flat-tappet mechanical cams which are of the low-taper design and hydraulic cams of both low-taper and standard taper designs. Using a lifter that is designed for a standard taper cam with a low-taper cam will result in scuffed lifters and cam. New lifters should always be used with a new cam and they should be of the design suggested by the cam manufacturer.

The lash caps are recommended for any camshaft with over .700" valve lift. The Apollo titanium retainers, PN P4007245 are recommended for serious racing when the "Battleship" valve spring is used. If titanium retainers are desired and either valve spring, PN P3690933 or P2806077 is to be used, then Apollo titanium retainer PN P4007178 should be selected. This retainer increases the install height, .070" from a standard setup.

The standard B-RB adjustable rocker arms PN 2463242 and 2463243 are recommended for racing use. For special purposes, blueprinted rocker arms are available in several ratios such as 1.55 or 1.60. Complete Package PN P4120974.

The standard B and RB mechanical lifter pushrods are acceptable for most purposes. If the block and head have been milled excessively, the length of the standard pushrods may be unacceptable. If this is the case or a custom length pushrod is desired, the pushrod kit PN P4007284 (which will make 16 pushrods) is recommended. Individual replacements

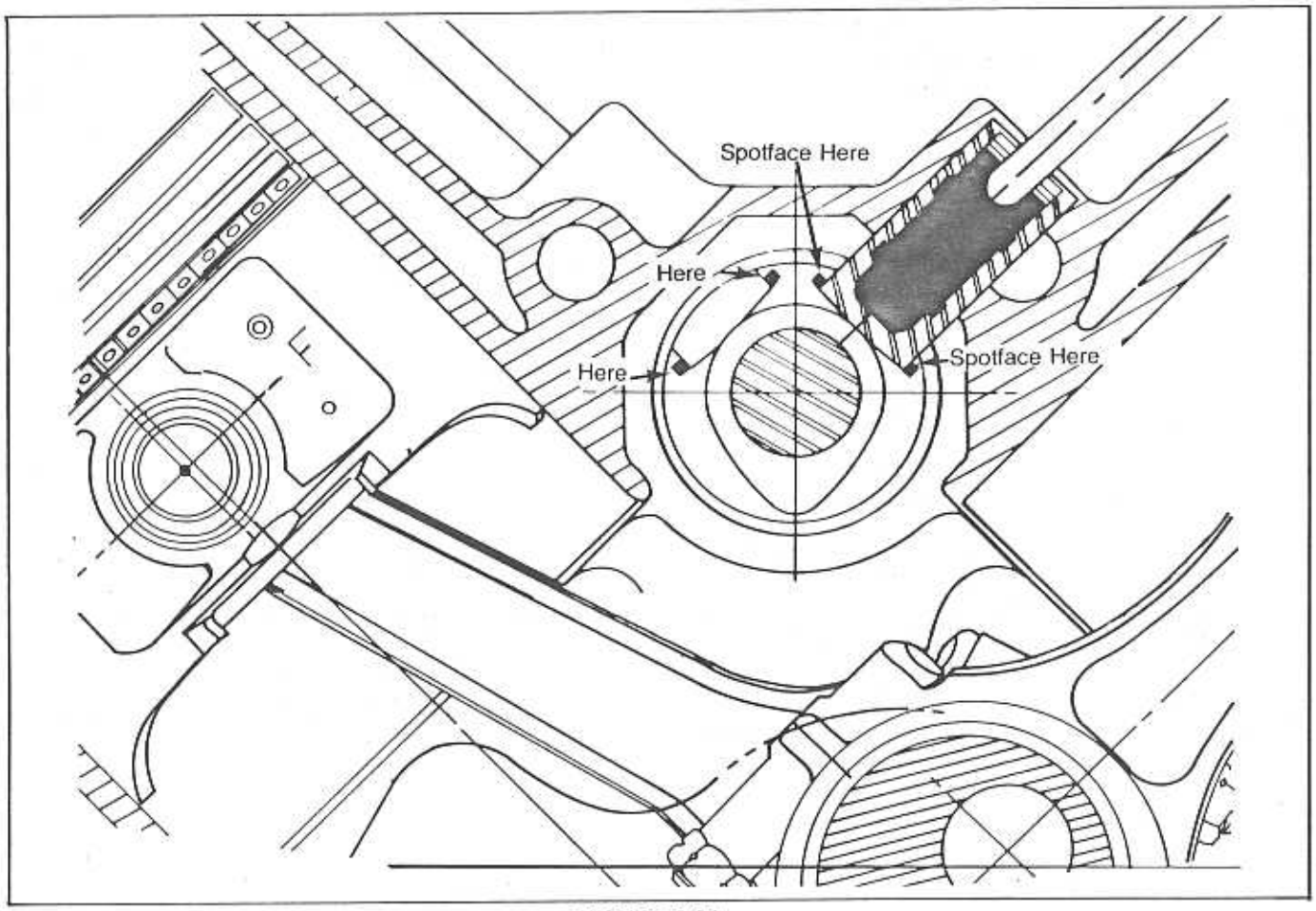


FIGURE 2-24

MUSHROOM LIFTER SPOTFACE

(which will make one pushrod) are available under PN P3690988.

Roller camshafts require the aluminum-bronze gear (see earlier section) and roller lifters. The Racer Brown roller P4007199 can be used for most applications especially in bracket racing. For the all-out highly modified engine, the Engle roller lifters P4120448 and guide bars P4120449 are recommended. Either roller lifter will work with any of the known roller camshaft profiles.

The B-RB engines use a pin in the end of the camshaft to locate the cam in relation to the cam sprocket. By using offset bushings (package of 4 PN P3690936) inserted into the sprocket, the installed centerline of the camshaft can be changed (advanced or retarded).

3. *Setting Valve Lash with Mechanical Camshafts*

To set valve lash with long duration mechanical camshafts (Chrysler, Racer Brown, Crane etc.), use the following procedure. Mark the vibration damper at TDC and 180° past TDC (diametrically opposite TDC). See chart listed below.

Crankshaft Position	Intake	Exhaust
#1 TDC Firing	#2 & #7	#4 & #8
Rotate 180° Clockwise (from front) to #4 TDC Firing	#1 & #8	#3 & #6
Rotate 180° Clockwise to #6 TDC Firing	#3 & #4	#5 & #7
Rotate 180° Clockwise to #7 TDC Firing	#5 & #6	#1 & #2

This is the four position valve setting. There is also an eight position method. With high lift, long duration race cams the eight position method is more accurate. The eight position method of valve lash adjustment is shown on self-adhesive firewall decal P4007707.

4. *Notching the Piston for Valve Clearance*

In many cases when large, long duration and/or high lift camshafts are installed in stock engines, a notch in the piston is required. The proper location for these notches is shown in Figure 18. Only the 440-6 bbl. stock pistons had piston notches from the factory. As a general rule camshafts of 290° duration and longer will require a notch. The '72-78 low compression engines aren't as critical as the earlier engines. The popular "Purple Shaft" hemi grind cam P3690214 will fit all production ('68-78) engines without any notching required. This holds true only as long as the heads have *not* been milled or the block decked.

The 8 to 1 compression ratio engines have a lot more valve to piston clearance than the earlier 10 to 1 engines. So the '72-78 will accept any of D.C. hydraulic cams and also D.C. mechanicals P4120659 and P4120661 without a valve notch as long as the heads or block haven't been milled or the pistons changed.

As a general rule in estimating valve to piston clearance you can change the cam or the compression ratio (pistons, head gaskets, heads or milling) but *NOT BOTH*. If both aspects are changed then you have no idea where anything is, so the clearance should be measured directly!

5. *Valve Springs*

The best valve spring to use is dictated by the cam choice and in particular the lift of the cam. The general spring recommendations for the various D.C. cams are shown in the chart below. Also see Section III, H and refer to Bulletin #44 for more information.

Camshaft	Duration	Lift	Valve Spring	2nd Choice
P3690214 Hyd.	284	.471	P3690933	—
P4120235 Hyd.	284	.484	P3690933	—
P4120237 Hyd.	292	.509	P3690933	P2806077
P4120659 Mech.	284	.528	P2806077	—
P4120661 Mech.	296	.557	P2806077	—
P4120663 Mech. P3690588	312	.590	P2806077	—
Mushroom	332	.655	P3462887	P4007536(1) P2946353(1)

(1) Installed at 2.00" instead of 1.86"

The Chrysler triple spring P4007536 is a very good bracket racer spring for use with the very high lift cams especially rollers. The triple has a lot of load both on the seat and open. To work best it is recommended that they be installed at 1.96" to 2.00".

6. *Cam Drive*

The stock engines use a "silent chain" while the high performance engines use a "roller chain". For high performance use, only the roller chain should be used. There is also a gear drive system for all-out race engines.

a. Chain Drive

The 440-6-BBL has the roller chain standard. To convert a silent chain to a roller chain, the chain, cam sprocket and crank sprocket are required.

	Roller Chain	Cam Sprocket	Crank Sprocket	Set
1 Bolt 'B' Engine	P3690279	P3690277	P3690280	P4120264
3 Bolt 'B' Engine	P3690279	P3690278	P3680280	P4120263
1 Bolt Mount		9417471		
3 Bolt Mount		2120930		
'B-RB' Engine Offset Bushings		P3690936 Required to Centerline Cam		
Crankshaft Damper Degreed Timing Tape		P4007657		

b. Gear Drive

Gear Drives can be used in Pro Stock or MP engines. The gear drive pieces for a 'B-RB' engine are the same as a Hemi. There is no advantage to running a gear drive on a bracket car. However, it won't hurt anything either except make its funny "whine". There are many gear drive manufacturers such as Donovan & Keith Black. The K.B. cam centerline is adjusted by multiple keyed crank gear, while the Donovan has multi-holed cam gear. They both use their own front cover and require a TDC marker to be installed. The gear drive cover should be sealed using RTV and no gasket. Using the gasket will cause it to leak. It is recommended that the cam gear cover be held on by 4 bolts ('B' — Hemi only). There are 5 holes. The fifth hole is on the bottom behind the vibration damper and should be filled with RTV.

K. Valve Gear

There are many small items in the valve gear which prove to be very helpful but are hard to find. General combustion chamber and valve gear layout — see Figure 2-25.

The installed valve spring height (outer) for the B-RB engine is generally 1.86" to 1.90". If camshafts of .700" plus valve lift and the Battleship valve springs are going to be used, then 1.88" to 1.90" installed height is preferred. The spring height should be measured after the valve job is done and with the retainer that is going to be used. Valve spring spacers are used to decrease the installed height of the spring thereby upping the closed load of the spring. The following spacers are available.

All with Std. Spring Seat (16 pieces)	PN P4120638	.060" Thick
	PN P4120639	.030" Thick
	PN P4120640	.015" Thick
All with Inner Spring Seat Removed (16 pieces)	PN P4120644	.060" Thick
	PN P4120645	.030" Thick
	PN P4120646	.015" Thick

In the race engines with the high lift cams and extra heavy duty valve springs, such as the Battleship, hardened keepers are recommended.

Hardened Valve Stem Locks (16 pieces)	1 Groove PN P4120618
	2 Groove PN P4120619
	3 Groove PN P4120620

For camshafts with valve lifts over .700", the 3/8 stem lash cap PN P3690763 is recommended to control the scuffing of the valve stem tip. The rocker arm shaft attaching bolts should be Grade 9 especially with the aluminum-stand type heads (pre-'64).

To optimize the rocker arm geometry, the pushrod kit PN P4007284 is recommended but only to the very serious racer or for engines with large amounts of head milling and block decking. The rocker arm tip should contact squarely over the tip of the valve. A rocker arm spacing package PN P3690896 is available to adjust the rocker tip and valve stem relation.

On the B-RB mechanical valve gear, a small spring PN 2202557 is placed over the rocker shaft between two adjacent rocker arms to keep them apart (in-

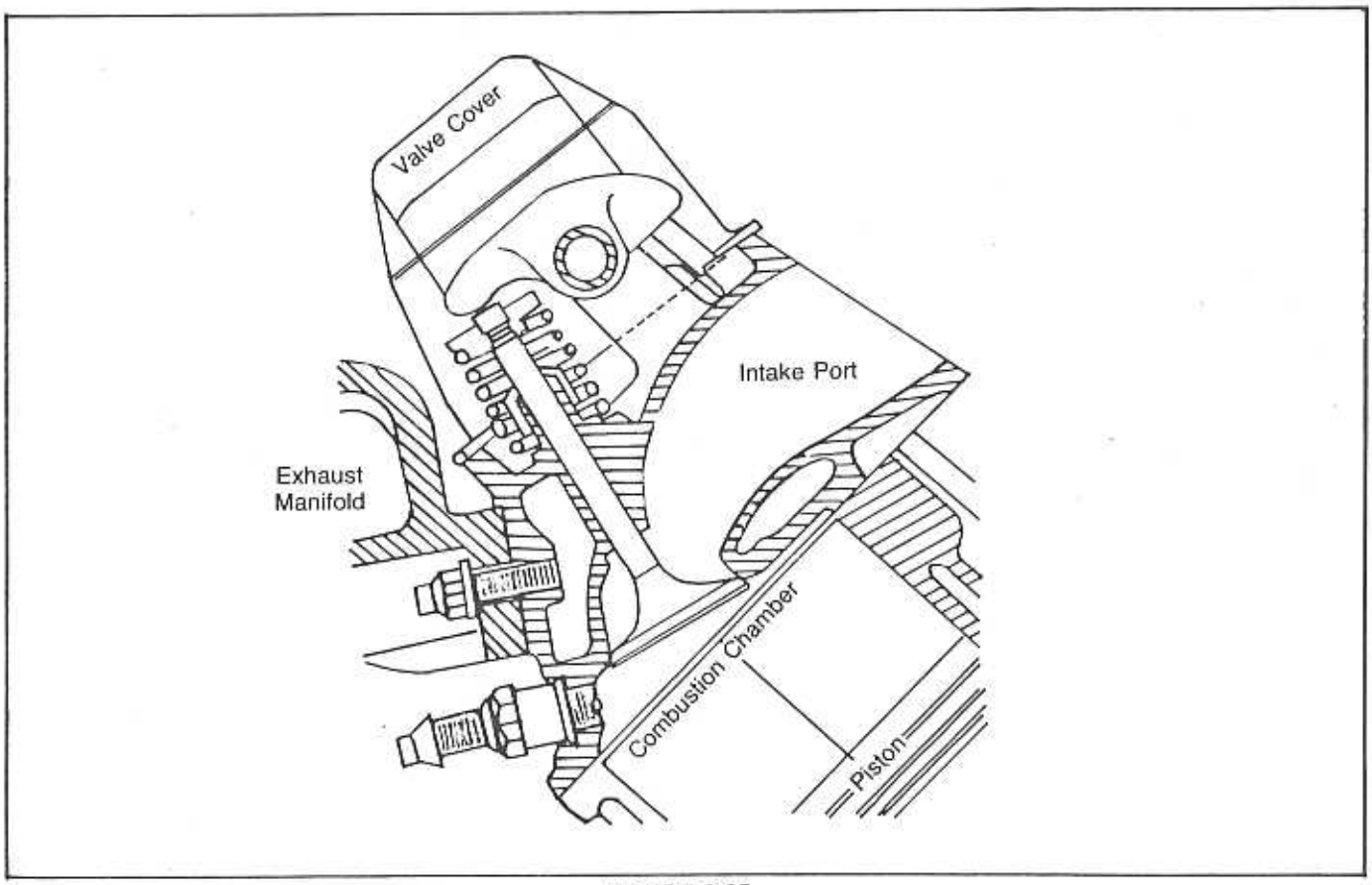


FIGURE 2-25

B/RB COMBUSTION CHAMBER & HEAD LAYOUT

cluded in D.C. Kit PN P4120974). Four springs are required per head. The mechanical rocker arm should use an adjusting screw and a lock nut. These pieces do wear out or get lost. D.C. package P4120636 includes one complete set (16 pieces each).

'B'-'RB' Mechanical Rocker Arms

When mechanical or roller camshafts are used, the 'B'-'RB' engines require the use of adjustable rocker arms. The original '62-64 Max Wedge rockers are almost totally depleted from the warehouses. With the popularity of the B-RB engines in Pro Gas, mechanical rockers are needed to work with the big mechanical flat-tappet and roller cam designs.

The old package, P4120893, supersedes to the new adjustable 'B' rocker arm package P4120974. The rockers are similar in design to the '64 Max Wedge — 1.5 design ratio, have a screw and nut adjustment, and the separator springs are included.

Oil Restriction To Valve Gear

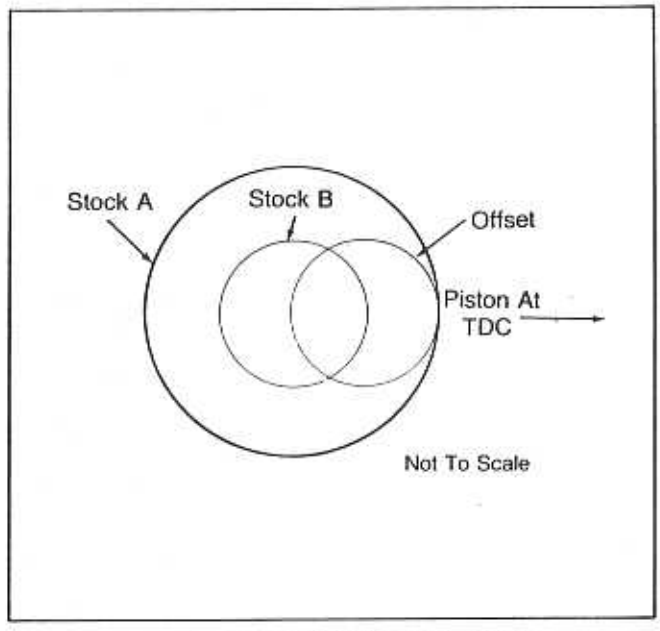
Restricting the oil to the tappet galley with roller lifters is a very common practice and in some cases even mandatory. However, restricting the oil to the upper valve gear is not recommended. The oil is fed to the upper valve gear through mating passages in the block and head. Restricting this passage cuts down on the amount of oil available to the valve gear (valves, rockers, pushrods). This causes two problems. At high rpm, the rocker arms like to "shake" the oil off that is used to lubricate the valve and pushrod tips. In most cases, the engine needs all the design oil flow to keep its durability high and minimize parts wear. The other problem occurs at low speed where the oil pressure drops to its minimum. In this condition, the valve gear, being the furthest from the oil pump, gets very little, if any, oil. The loads are low but with so little oil, any less can cause accelerated wear. In either case, scuffed valve tips, burned pushrod ends, gauled rockers can be the result which is why oil restriction to the heads is not recommended. This is particularly important with mechanical valve gear.

The '63 and earlier 'B' engines used a rocker shaft support or stand. The pedestals were machined off flat and the support and rocker shaft were attached to the head by long bolts. The '64-78 pedestal-type support cast into the head is the better system because it is simpler and more rigid.

General purpose high performance hydraulic tappets P4006767 are available for the D.C. hydraulic cams. Mechanical tappets P2843177 are available to reduce the chance of sticking with the high load valve gear. The mushroom-lifter P3690137 can only be used with mushroom-lifter designed camshafts because mushroom cams have narrowed lobes so that the oversize bottom of the lifter doesn't hit on two lobes at once.

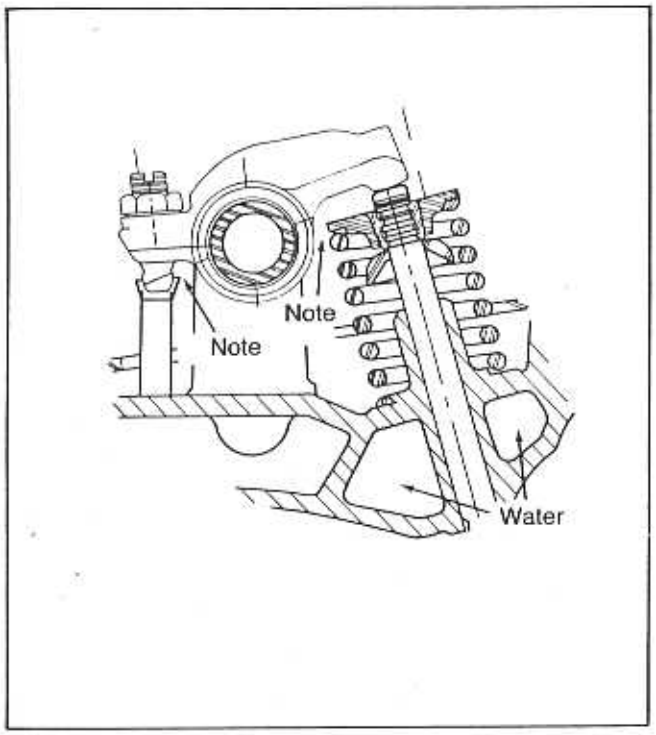
All of the retainers and keepers mentioned previously are based on the 8 degree system. However the latest racing package (like Pro Stock) is a 10 degree system. This requires new keepers and retainers but they are much less prone to "pulling through" with the high spring loads than the earlier system.

The B-RB engines use only the 3/8 stem valves so that only the 10 degree keepers for the 3/8 stem valve P4120788 need to be used (5/16 and 11/32 also available using same retainers). There are three 10 degree retainers for varying spring applications. First is the 10 degree retainer for Hemi-B dual springs P4120784 which will install at the standard B-RB valve spring installed height. Next is the increased installed height retainer (from the A engine) P4120785. It increases the installed height .070" over standard. Last is the triple spring retainer P4120783 for use only with triple springs.

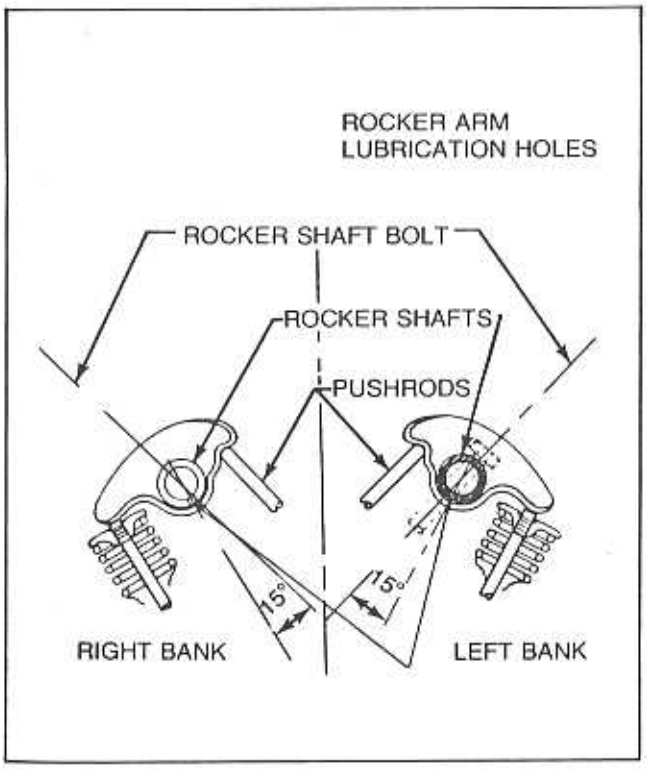


OFFSET CRANKPIN GRINDING
FIGURE 2-26

Recently there has been a demand for different stroke lengths than those used in production (both longer and shorter). Custom-made billet cranks are very expensive and have longer lead times. The stock crank can be offset-ground to a smaller size



PUSHROD AND SPRING
TO ROCKER CLEARANCE
FIGURE 2-27



ROCKER SHAFT INSTALLATION
FIGURE 2-28

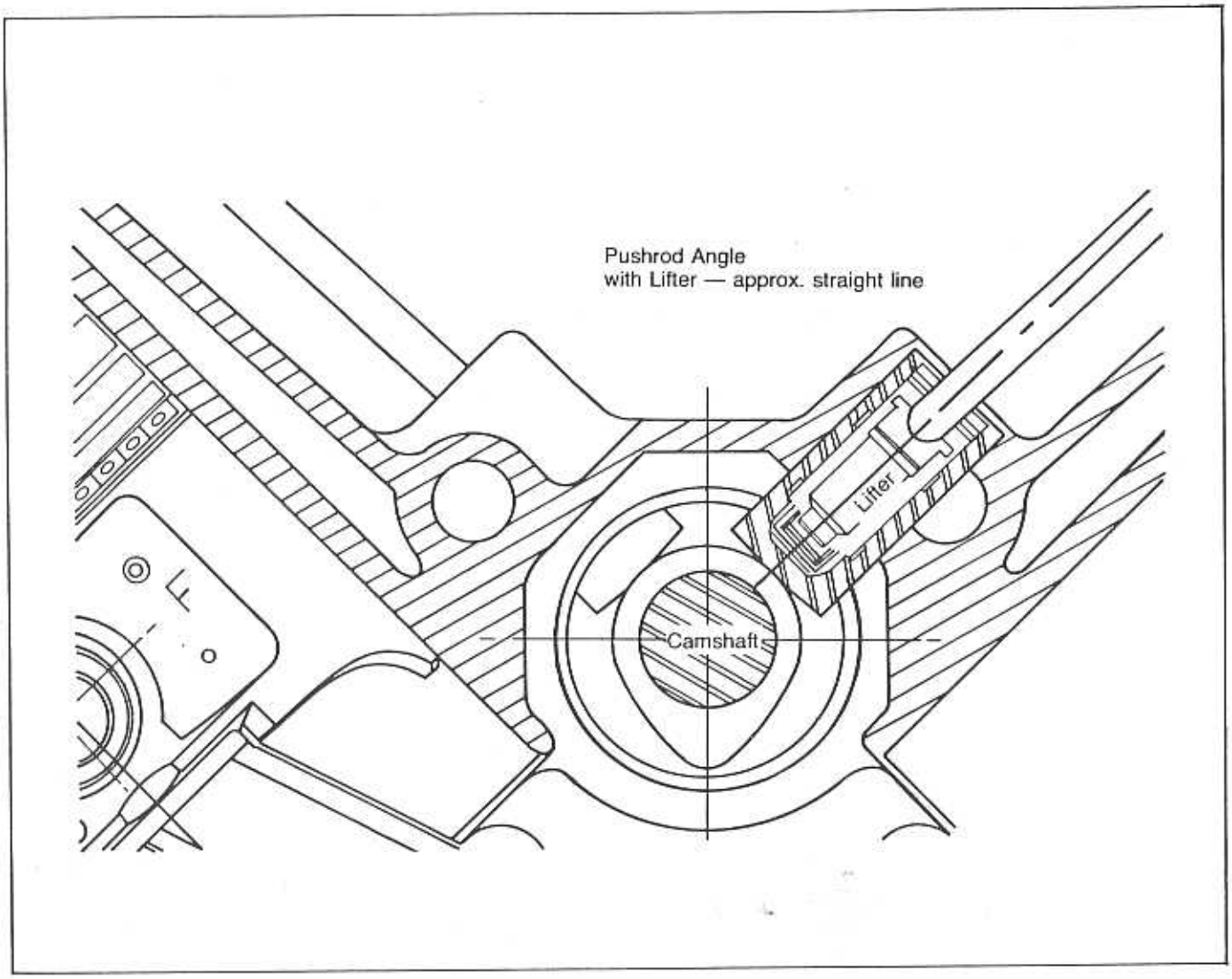
(rod journal). See Figure 2-26. The B engine crank lends itself to this (properly done) because the journal is large. For example the B journal is 2.38" while the A is 2.125" which means "mathmatically" the crank *could* be stroked or destroked 1/4". Other popular rod journal sizes are 2.0995 and 2.1995. This approach opens up many possibilities too numerous to cover here. We are *NOT* recommending that this be done only informing the engine builder of the options. The smaller journal sizes threaten to break through the production crankpin balance hole. Grinding the crank undersize (offset or on centers) should *ONLY* be done by a professional and should be based strictly upon his recommendations. This is true of the rod and main journals. The mains must be ground on-center (440 crank in a 383). These style engines are more expensive and are best left to professional engine builders.

The B-RB engines valve gear also has larger pieces (rockers dimensions) which give added clearance for large diameter valve springs and pushrod clearance for high lift cams. See Fig. 2-27.

In assembling the rocker shafts (mech. or hyd.) install the rocker shafts so that the 3/16" dia. rocker arm lubrication holes point downward, so that the 15 degree angle of these holes point outward towards the valve end of the rocker arms (toward exhaust flange as installed on the head). See figure 2-28.

The valve train geometry refers to items like pushrod angle, the angle the rocker arm makes with the valve and pushrod, etc. The Hemi seems to have more problems than the wedge. The 'B' pushrod is almost perfectly straight with the lifter. See figure 2-29. We have investigated ball-stud, valve gear versus the standard rocker shaft system and high offset rockers (like A-W2 intakes) versus straight (like B engine), but gains seem to be small. The B-RB is the simplest, inexpensive race system.

There is a lot of horsepower in cylinder head flow but the flow bench is not a dynamometer. Increasing the max. cfm that the port flows may not increase the car's performance. As a general rule it is better to increase the flow at low and intermediate lifts than the flow at max. lift. The B engine ports don't "stall" (more lift yields less flow). The B ports flow equal or more cfm with more lift which is why the B engine race cars like cams with a lot of lift (.750"). See Bulletin #44.



'B' PUSHROD ANGLE WITH LIFTER

FIGURE 2-29

IV.
SPECIAL CONSIDERATIONS

There are always some items that don't fit in any category or may overlap into several categories. These special topics we'll cover in this section by themselves.

1. *Compression Ratio Increase for '72 thru '78*

   The '72 thru '78 400 and 440 compression ratio is approximately 8.5:1. Milling the heads .060" increases the 400's compression ratio to almost 10.0:1. Milling the 440's heads .060" raises the compression ratio to approximately 9.8:1. Raising the compression ratio further becomes much more expensive. Installing the '67 440 heads, also milled .060", would increase the compression ratio of either engine another .5 point because the '67 heads have a smaller combustion chamber. The other choices in raising the compression ratio are to change the pistons and/or mill the block deck surfaces.

   The following compression ratio charts, one for each 'B'-''RB'' engine displacement, show the resulting compression ratios from a variety of deck heights, cylinder head volumes, and bore sizes. It is based on a flat piston — i.e., no valve notches. These compression ratio charts are

	Gasket	Deck Height	cc Head Volume	Exact Cubic Inches 360.5 Std. Size Bore	364.0 .020 Over-size	367.5 .040 Over-size
361 in.³ Engine	.020	.040	86.0	8.45	8.51	8.58
			80.0	8.93	9.00	9.06
			74.0	9.48	9.55	9.62
		.020	86.0	8.79	8.86	8.93
			80.0	9.32	9.39	9.47
			74.0	9.92	10.00	10.08
			86.0	9.17	9.25	9.32
			80.0	9.75	9.83	9.91
		0	74.0	10.42	10.51	10.60

	Gasket	Deck Height	cc Head Volume	Exact Cubic Inches 383.6 Std. Size Bore	387.2 .020 Over-size	390.9 .040 Over-size
383 in.³ Engine	.020	−.020	86.0	9.25	9.32	9.39
			80.0	9.80	9.87	9.95
			74.0	10.43	10.51	10.59
		0	86.0	9.67	9.75	9.82
			80.0	10.28	10.37	10.45
			74.0	10.99	11.08	11.17
		+.020	86.0	10.14	10.22	10.31
			80.0	10.82	10.91	11.01
			74.0	11.62	11.72	11.82

	Gasket	Deck Height	cc Head Volume	Exact Cubic Inches 400.0 Std. Size Bore	403.7 .020 Over-size	407.4 .040 Over-size
400 in.³ Engine	.020	.080	86.0	8.43	8.49	8.54
			80.0	8.86	8.92	8.97
			74.0	9.34	9.40	9.46
		.050	86.0	8.96	9.02	9.08
			80.0	9.45	9.51	9.58
			74.0	10.01	10.08	10.14
		.020	86.0	9.56	9.63	9.71
			80.0	10.14	10.21	10.29
			74.0	10.79	10.87	10.95

	Gasket	Deck Height	cc Head Volume	Exact Cubic Inches 413.6 Std. Size Bore	417.6 .020 Over-size	421.6 .040 Over-size
413 in.³ Engine	.020	.040	86.0	9.51	9.58	9.65
			80.0	10.06	10.13	10.21
			74.0	10.68	10.75	10.83
		.020	86.0	9.92	9.99	10.07
			80.0	10.52	10.60	10.68
			74.0	11.20	11.29	11.38
		0	86.0	10.36	10.45	10.53
			80.0	11.02	11.12	11.21
			74.0	11.79	11.89	11.99

	Gasket	Deck Height	cc Head Volume	Exact Cubic Inches 425.6 Std. Size Bore	429.6 .020 Over-size	433.6 .040 Over-size
426 in.³ Wedge Engine	.020	.040	86.0	9.72	9.79	9.86
			80.0	10.28	10.36	10.43
			74.0	10.91	10.99	11.07
		.020	86.0	10.15	10.23	10.30
			80.0	10.76	10.85	10.93
			74.0	11.47	11.55	11.64
		0	86.0	10.62	10.70	10.79
			80.0	11.30	11.39	11.48
			74.0	12.08	12.18	12.28

	Gasket	Deck Height	cc Head Volume	Exact Cubic Inches 439.7 Std. Size Bore	443.8 .020 Over-size	447.9 .040 Over-size
440 in.³ Engine	.020	.060	86.0	9.56	9.63	9.69
			80.0	10.08	10.15	10.21
			74.0	10.66	10.73	10.80
		.030	86.0	10.19	10.26	10.34
			80.0	10.79	10.87	10.95
			74.0	11.47	11.56	11.64
		0	86.0	10.92	11.01	11.09
			80.0	11.62	11.71	11.81
			74.0	12.43	12.53	12.63

given for a reference only. The specifications shown in the charts were selected to be representative of actual engines.

2. *Compression Ratio Decrease for Pre-'72*

With the advent of the low octane pump gasoline, high compression ratios tend to "ping" and "rattle" in detonation. This is bad for the engine and causes poor performance. The quick and easy solution to this "bad gas" problem is to back up the spark advance. This results in poor perfomance but won't damage the engine. The best permanent solution is to lower the compression ratio. The engine will perform better on pump gas with lower C.R. and full spark advance than with high C.R. and backed-up spark.

The thicker Fel-Pro head gasket P4120754 will lower the C.R. approximately 1/2 point. If a further lowering is required, the pistons will have to be changed. The heads can be changed to stock if the ones currently on the engine have

been milled. While the heads are off (changing gaskets) a fresh valve job can be done. The chamber can be polished and the valve unshrouded, but this is a lot of work and may only increase the chamber volume 3 or 4 cc's which will only lower the C.R. 1/4 of a point.

3. *Engine Swapping*

For engine swapping purposes all B and RB engines use the same motor mount attaching lugs on each side of the block and they all use the same bolt pattern at the back of the block for bellhousing attachment. The back of the block bolt pattern is the same as the 426 hemi; however, the hemi uses a completely different motor mount system.

The B and RB engine assemblies are between 75 and 100 pounds heavier than an LA engine (340 or 360) which is a very good lightweight engine package. However, the added displacement of the B and RB engine compensates for the added weight of the engine package. On an overall weight per cubic inch, the RB (440) engines have a better #/in.^{3} number than the best of the LA engines while the B (383) engines are about equal to the LA engines. Also, the B and RB engines are slightly lighter than most of the other big block engines available. The typical dimensions are:

	383-400	426-440
WIDTH		
Outside Valve Cover to Outside Valve Cover	22.5	23.8
Oil Pan (Sump)	8.25	8.25
Prod. Exh. Manifolds	26.25	28.8
LENGTH		
Bellhousing Face to Front of Block	23.4	23.4
of Fan Belt	27.2	27.2
Front of Fan	32.8	32.8
HEIGHT		
Bottom of Pan to Top of Prod. Air Cleaner	29.7	30.0
Top of Carb.	25.5	26.3
Top of Valve Cover	22.2	23.1
Pan Rail to Top of Valve Cover	17.0	17.7

Above numbers are approximate.

There is a very large group of Mopar engines from which a Street Rodder can select his personal favorite. Each one may offer certain unique features that may fit the rodder's particular requirement. The big block 361 383-413-426W-440 group (B-RB) is one of the least expensive engines to obtain, they are easy to locate used, there are many H.P. and dress-up parts available, resulting in an inexpensive engine build-up that looks nice and performs well.

We'll now look at an example of the B-RB engine in "street rod". Street rods are cars with new ('60-80) engines installed in pre-1950 bodies. The later 50's and 60's hot rods are considered "street machines". Most street rods require a certain amount of fabrication for the installation of the modern engine. This is true of the all Mopar "purist" group (Mopar engine in Mopar body) or if the Mopar engine is being installed into a Ford or GM body. A '34 Dodge 2 Dr. Sedan wasn't designed with a 383 engine in mind since the body existed over 20 years before the engine was built.

Before we get to the various performance features of our engine selections, we should cover some items that are common to the group as a whole. They are all "modern" engines that were recently produced and new parts are easy to obtain. Since they are current, the aftermarket manufacturers have readily available intake manifolds, headers, camshafts for them as does the Direct Connection. This is a great convenience for the rod builder and can be a cost saving in the long run. Most street rodders want a unique vehicle that reflects their individual expression. The Mopar engine approach is "unique" because everybody and his brother doesn't have one. The Mopar engine installed in a Mopar body or some other body is more for the man who thinks for himself. The B-RB Mopar engines, as a whole, offer many engineering features that are not found in other brands, such as long ram manifolds, 6 barrel setups, cross-rams, Tunnel rams and B-RB inline setups that are externally visible and help score points for best engineered at the various "rod " gatherings. B-RB engines are strong so that they will live with a blower installation. Keep in mind that the oiling and bottom end is very similar to a Hemi which is the standard engine in the 2000 hp Funny Cars.

Now, let's get down to some specifics on performance considerations and compare the B engine to one of the more popular engine choices. Horsepower is what makes the vehicle perform so that's what we'll use to compare the engines.

We'll choose the 350 small block GM engine and the 383 Mopar. NHRA will be the source of the horsepower numbers since they are a major sanctioning body (in drag racing) and are responsible for "rating or factoring" all the various engines. The two engines selected race in the same class. The small block has an 11.5 compression ratio and is rated by NHRA at 305 hp while the 383 has a 9.5 C.R. and is NHRA rated at 330 hp. In a 2200# "T-bucket" street rod, the small block would be a .139 hp/lbs. package while the 383 which is 100 pounds heavier than the small block, would be .143 hp/lbs. This shows that even though the 383 is heavier and has a low compression ratio it has a higher hp/lbs. number and therefore more performance potential than the small block. As Super Stock rated packages they are representative of a production-salvage engine i.e. stock heads, C.R., carb and bottom end.

V.
HEADERS & EXHAUST SYSTEM

The first step toward improving the performance of any stock production engine is to make sure that the exhaust system offers as little restriction as possible to the exhaust gas flow. A proper dual exhaust system will increase power up to 8% by reducing back pressure within the system and allowing more rapid and complete scavenging of the cylinders.

A. Cast Iron Exhaust Manifolds

For older "B" engines with the "log" type exhaust manifolds, the newer design used on the '68 and up 440 High Performance GTX, R/T and 383 Road Runner, Super Bee engines will offer a performance increase. Also available are the max. wedge headers from the '62, '63, and '64 Super Stocks which offer a greater performance gain, but are very difficult to find.

B. Headers

For best results in all-out competition, the 4 to 1 header designs must be used. See Figure 2-30. The primary tube diameters and lengths along with the collector size for the various applications are shown in the following chart. These headers are available from Stahl Header Co., Doug's Headers, Cyclone Headers and many others.

	Primaries	Collectors
General Performance 361-383-400	1¾ x 36-42	3" x 12
Bracket Racer	1⅞ x 36	3" x 12
440 Bracket Racer	2" x 36	3½" x 12
383-400 Bbl. Super Stock	2" x 34	3½" x 12
440-6 Bbl. and 426 Max. Wedge Super Stock	2⅛ x 36	3½ x 12-18
426-440 Grand National	2¼ x 36	3" x 12 w/H pipe

NOTE: In general, most B and RB engine bracket racers with an automatic transmission and large drag slicks, the primary length of the headers should be 42".

C. Mufflers

There are many low restrictions straight-through type mufflers available through various speed equipment manufacturers and dealers. For the most part these units are too noisy for legal street use. Factory mufflers, PN 2781300 as used on 1966 and 1967 street hemi models, are satisfactory.

For best efficiency the connecting, or exhaust pipes, between headers and mufflers should have a minimum outside diameter of 2½". By placing an interconnecting pipe (2" minimum diameter) between the two head pipes, somewhere between the headers and mufflers, the noise level of the modified system can be greatly reduced. (This also produces more horsepower.)

For the maximum off-road engine output with a closed exhaust system, '71 Imperial mufflers, PN 3466644, should be used. They have large diameter 2½" inlet and outlet pipes and therefore may require special adapters to allow their use. They are also longer. They should be used with large diameter tubing and mandrel bends, when necessary, in place of the standard exhaust and tailpipes. The Imperial muffler is longer than standard and will not fit on a Duster-Sport size (A-Body) body-style.

All exhaust systems should be checked for leaks. A leak in the exhaust system is unsafe and will cost you power.

D. Tail Pipes

In most instances it will be necessary to fabricate tail pipes to fit your particular car. These should have a minimum O.D. of 2⅛" for best results. Do not, under any circumstances, use flexible tubing anywhere in the exhaust system as the efficiency of the flow will be reduced.

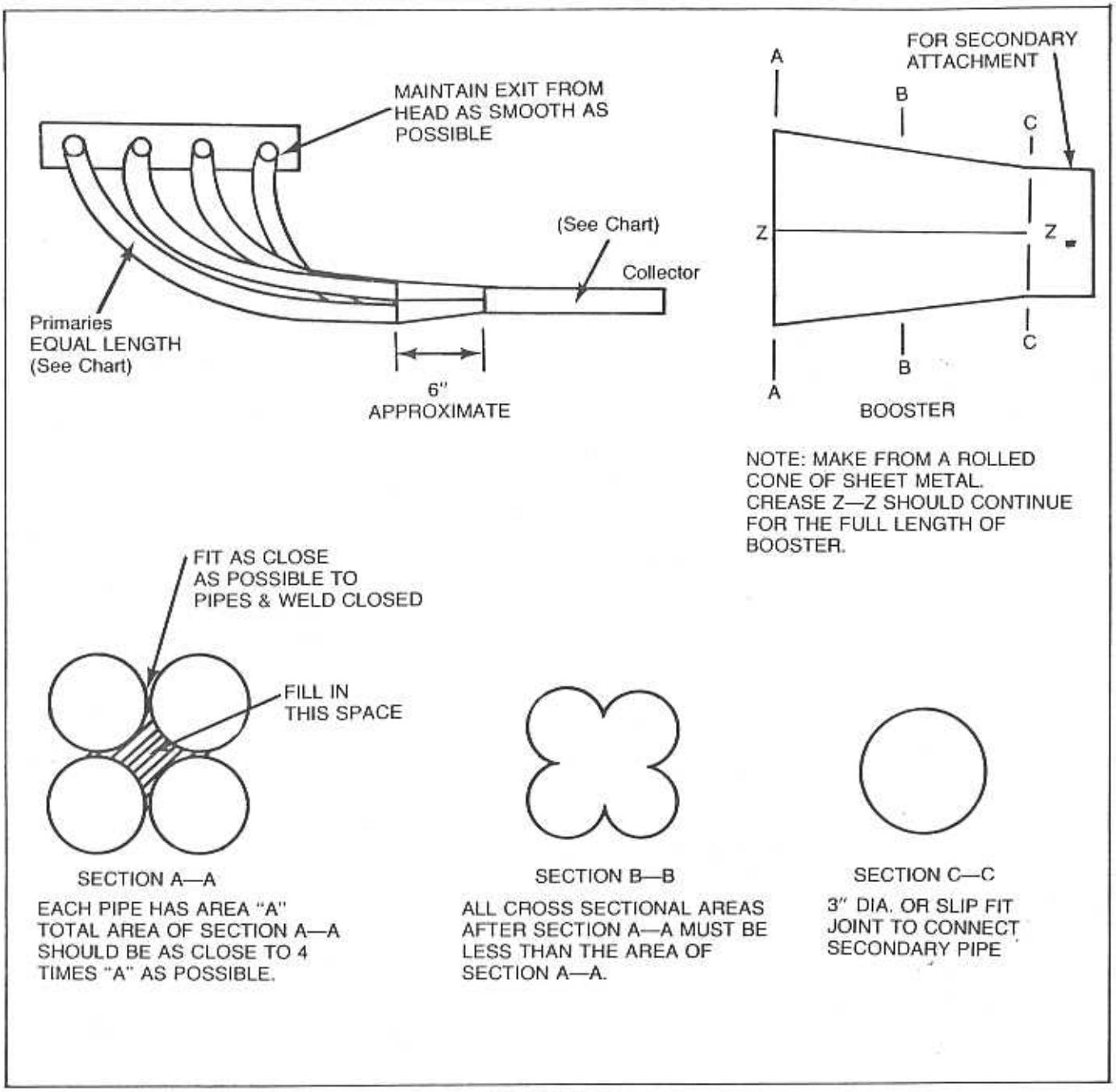


FIGURE 2-30

EXHAUST HEADERS

VI.
ENGINE BUILDING SPECS

There are many clearances and torque specifications in the engine that are necessary to build the engine correctly. The more common ones that are critical during engine assembly are detailed in the following sections. The appropriate service manual for the engine being built has more details.

A. Clearances — Drag Racing Engines

Bearing Clearance — Rods & Mains	.0025 — .003
Connecting Rod Side Clearance	.009 — .017
Piston-to-Wall Clearance (Stock type pistons)	.0015 — .002
Forged Race Pistons	.0075 — .009
Ring End Gap	.016 — .020
Valve to Piston	.100 (Manual) .090 (Automatic)
Crankshaft End Play	.002 — .010
Tappet Clearance in Block	.0010 — .0023

B. Torque Specifications

383-440 CUBIC INCH ENGINES

Connecting Rod Nut — Plain	45
Connecting Rod Nut — H.D.	50 — 55 with oil
Cylinder Head Bolt	70
Main Bearing Cap Bolt	85
Spark Plug	30
Camshaft Lockbolt	35
Carburetor to Manifold Nut	7
Crankshaft Rear Bearing Seal Retainer	30
Crankshaft Bolt (Vibration Damper)	135
Exhaust Manifold Nut	30
Flywheel to Crankshaft	55
Flex Plate to Crankshaft	55
Flex Plate to Converter	270 in.-lbs.
Fuel Pump Attaching Bolt	30
Intake Manifold Bolt	40
Oil Pan Bolt	15
Oil Pump Cover Bolt	10
Oil Pump Attaching Bolt	35
Rocker Shaft Bracket Bolt	25
Starter Mounting Bolt	50
Vibration Damper Pulley Bolts	200 in.-lbs.
Valve Tappet Cover End Bolt	9
Water Pump Housing to Cylinder Block Bolt	30

VII.
SPECIAL CAR PACKAGES

Over the past twenty years there have been many special car packages put together by Chrysler and sold through our dealer system. We called these cars "Package Cars". They usually included a special engine package along with body-chassis modifications. Many of these "Package Cars" were based on the B-RB engines.

A. 1969-71 440-6 Bbl

There are many special features about the 440-6 Bbl. other than just the intake manifold and carbs. Some of these items are heavy-duty rods, external balancing, heavy-duty rocker arms, special low compression ratio. All of these cars in 1969 were built with aluminum manifolds, while in 1970 and 1971 the manifolds were both cast iron and aluminum.

1969-71 440-6 Bbl.

6 Bbl. Crank	PN-3512036
Crank Sprocket	PN-2205568
Cam	PN-3512905 (71)
Camshaft Sprocket	PN-2780572
Screw (3 Required)	PN-2120930
Timing Chain	PN-2205569
Connecting Rod	PN-2951906
Piston (Notched — Std. Bore)	PN-3420218
Rings (Std. Bore)	PN-3420228
Intake Valve	PN-3418475
Exhaust Valve	PN-3418479
Valve Springs	PN-3418491
Cam Tappet	PN-3420039
6 Bbl. Rocker Arms	PN-2946033

These are the special pieces put into the 440-6 Bbl. engine other than the obvious carb and manifold system.

B. 1962 Plymouth Dodge 343 hp 383 Specifications

Displacement	383 Cubic inch
Bore	4.250"
Stroke	3.380"
Carburetor	
Front	Carter AFB 2970S or 3258S
Rear	Carter AFB 2971S or 3259S
Cylinder Head Volume	66.5 cc Min.
Deck Clearance	.023" Below
Cam Specs: Part Number C-284	284°-284°-40° with .425" lift
Available From:	Clay Smith Engineering 5870 Dale Street Buena Park, California

Intake Valve Dia.	2.080"
Exhaust Valve Dia.	1.740"
Valve Spring Specs:	
Outer Valve Spring Close	100# @ 1.86"
Outer Valve Spring Open	195# @ 1.47"
Inner Valve Spring	Damper Only

1962 383 CU. IN. 343 HP 2-4 Bbl.

Front Carb AFB 2970S:

	Left	Right
Primary		
Jet	120-389 (.089")	120-389 (.089")
Metering		
Rod	16-81 (.070"x.067")	16-81 (.070"x.067")
Secondary		
Jet	120-185 (.067")	120-185 (.067")

Rear Carb AFB 2971S:

	Left	Right
Primary		
Jet	120-159 (.089")	120-159 (.089")
Metering		
Rod	16-192 (.081"x.068"x.045")	16-192 (.081"x.068"x.045")
Secondary		
Jet	120-174 (.055")	120-174 (.055")

C. 1963 Stage III 426 In³ Super Stock

Combustion Chamber Volume	81 cc min.

(To reduce the volume of the combustion chamber 1 cc — .005" must be milled from the head surface. For each .010" removed from the cylinder head .012" must be removed from each intake part side of the intake manifold and .017" from the bottom of the intake manifold.)

Deck Height	.0155" min. (11.0 to 1 C.R.) .0180" min. (13.5 to 1 C.R.)
Piston to Wall Clearance	.009 — .010"
Ring End Gap	.014 — .081"
Camshaft	
Lift	.509"
Overlap	75°
Duration	300°-300° PN-2402293 at 108° Centerline Valve Lash Cold — Intake .028 — Exhaust .032
Valve Springs:	
Outer	Closed — 110# @ 1.83 Open — 276# @ 1.36
Inner	Closed — 31.5# @ 1.56 Open — 50# @ 1.13
Main Bearing Clearance	.0025 — .003"
Rod Bearing Clearance	.0025 — .003"
Carburetors:	
Model	AFB-3447S
Throttle Bore	
Primary	$1^{7}/_{16}$"
Secondary	$1^{11}/_{16}$"
Main Jet	
Primary	.098" (120-163)
Secondary	.082" (120-158)
Step-Up Rod (2 Stage)	.068 — .050" (16-51)

NOTE: If the production carburetor entrances are not available, Offenhauser makes 4" air horns that may be used.

Valve Specifications — The valve seat approach angle should be 80° with approximately .070" seat width.

D. 1964 426 Max. Wedge

Carburetors:	
Model	Carter AFB 3705S
Primary Bore Size	$1^{11}/_{16}$"
Secondary Bore Size	$1^{11}/_{16}$"
Primary Jet	120-404; .104"
Secondary Jet	
Choke Side	120-176; .063"
Throttle Side	120-389; .089"
Metering Rods	16-76; .066" x .053"
Float Setting	7/32"
Blade Angles (at WOT)	
Primary	Vertical
Secondary	6° from Vertical
Combustion Chamber Volume	86 cc min.
Deck Height	.0155" (11.0 C.R.) .0180" (12.5 C.R.)
Cam	320°-320° Duration 96° Overlap .520" Lift

E. '67-68-69 383 A-Body

Carburetor	Carter AFB 4 Bbl. in '67 AVS 4 Bbl. in '68-69
Horsepower rating	280 hp in '67 300 hp in '68 330 hp in '69

Camshaft	268-276 duration .450 lift hyd. in '68-69 256-260 duration .430 lift hyd. in '67

Special Exhaust Manifolds

No fresh-air

Auto. and Manual Transmissions

F. '69 440 A-Body

The first RB A-Body was the '68 Dart of which 50 were produced for Super Stock. The '69 was both a Dart and a Barracuda and was much more readily available.

Carburetor	Carter AVS 4 Bbl.
Horsepower Rating	375 hp
Camshaft	268-276 duration .450 lift hyd.

No fresh-air

Auto. and Manual Transmissions

G. D.C. 'B' Engine A-Body

The parts that it took to install the B-RB engine into the '67-76 A-Bodies are no longer available. The installation can be accomplished by using D.C. K-member P4007935 which puts the engine in the same location as the '67-69 production cars. This system uses the new style motor mounts from '75 B-Body. For more details refer to Bulletins #28 and #39.

VIII.
RACING ONLY PACKAGES

Now that the individual systems and special parts and operations have been covered, we can try to put them together into a complete engine to go racing.

A. NHRA Stock

The current NHRA stock rules allow cars back to 1960. This allows many different B-RB engines to be reasonably competitive in stock eliminator. Various versions of the 383, 400, 426 W and 440 can compete in every class from A/S through M/S. A general outline of the parts required is as follows.

The 069J torque converter PN P3571084 is the best choice for all the B-RB engines. If the car is very heavy or has excellent traction (weight distribution) then the Turbo-Action 3800 torque converter PN P4007290 could be used. The Turbo Action manual shift valve body PN P4007291 is recommended for the automatic trans. and the 3100# race clutch PN P3515678 is recommended for the manual. The Carter electric fuel pump PN P4007038 and mechanical pump PN P4007039 are recommended for the fuel system.

The high output electronic ignition is the best ignition with the wide gap plugs. The oil pan must be stock, but the windage tray and an acceleration baffle should be used. Headers should be used that have 1¾ to 1⅞ primary tubes 36" to 42" long. A foot to 18" collector is suggested. The exact header design will change with the track and chassis setup.

Be sure to check the casting numbers on the heads and intake manifold. A "cheater" or "blueprint" camshaft is a must. They can be obtained from Cam Dynamics, General Kinetics, Crane, Lunati, Competition Cams and Race Cams Inc. The hydraulic "blueprint" cam for the '67-75 440-4 Bbl. H.P., '68-71 383-4 Bbl. H.P., '72-76 400-4 Bbl. H.P. and all 440-6 Bbl's is PN P4007277 (a Cam Dynamics design). See Bulletin #35 for further information.

B. IHRA-NHRA Super Stock

The Super Stock engine packages change frequently and are therefore primarily covered in a separate Bulletin #33 that is smaller and easier to keep up-to-date. The engines that might be considered competitive are the '63-64 426 Max. Wedge, '70-71 383-4 Bbl, '69-71 440-6 Bbl., '72-76 400-4 Bbl., '72-76 440-4 Bbl., and the '62 383-8 Bbl.

The best ignition system is the Gold Box with the wide gap plugs. Two Carter electric pumps in parallel are needed for the fuel system. The Milodon oil pump with a race custom-made oil pan should make up the oil system. The headers should be 2" x 34" for the 383 and 400, and 2⅛" x 36" for the 426W and 440.

The intake manifold and camshafts vary with the engine. The 426 Max. Wedge should use the stock cross-ram intake manifold and the CD R286-500 camshaft PN P4007279. The 440-6 Bbl. should use the STR-14-6 (PN P3690187 Top and P3690248 Bottom) intake manifold and the CD R286-500 camshaft. The 383-4 Bbl. should use a CD R286-500 camshaft and the Holley P4007937 intake manifold.

The 383-8 Bbl. should use the CD R286-500 camshaft and the STR-15-8 intake manifold (PN P3690249 Bottom and PN P3690191 Top).

The Weiand 6BBL P3690982 is optional recommended if hood clearance allows.

NHRA ENGINE BLUEPRINT SPEC'S

Cubic Inches		Min. Head Volume (cc's)	Max. Deck Height (inches)	Head Milling Spec's
440-6 Bbl.	(1970-71)	79.5	– .001	For the 73.5 cc chamber heads remove .0062 from the head surface per 1 cc of chamber volume. For the 79, 81 and 83 cc chamber heads, remove .0042 from the head surface per 1 cc of chamber volume. For each .010 removed from the head, .0123" must be removed from the intake face of the head.
	(1969)	79.5	– .027	
440-4 Bbl.	(1976)	81.5	– .113	
	(1974-75)	83.1	– .123	
	(1972-73)	81.95	– .123	
	(1970-71	79.5	– .051	
	(1968-69)	79.5	– .027	
	(1966-67)	73.5	– .059	
426	(Street Wedge)	73.5	– .042	
413		73.5	– .038	
400-4 Bbl.	(1976)	81.5	– .065	
	(1974-75)	83.1	– .075	
	(1972-73)	81.95	– .075	
383-4 Bbl.	(1971)	79.5	– .019	
	(1970)	79.5	– .004	
	(1968-69)	79.5	+ .0205	
	(1967 & Prior)	73.5	– .014	
361		73.5	– .038	
SPECIAL				
1964 426 Max. Wedge				To reduce the volume of the combustion chamber 1 cc, .005" must be milled from the cylinder head and .012" must be removed from each intake face of the head or manifold and .017" from the bottom of the intake manifold.
415 HP		86.0	– .0155[5] (pop-up)	
425 HP		86.0	– .018[2] (pop-up)	
1963 426 Max. Wedge				
415 HP		81.0	– .0155[1]	
425 HP		81.0	– .018[2]	
1962 413 Max. Wedge				
410 HP		81.0	– .0155[3]	
420 HP		81.0	– .019[4]	
[1] pop-up = .094 6.9 cc				
[2] pop-up = .330 26.0 cc (25.5 cc in '63)				
[3] pop-up = .089 —				
[4] pop-up = .450 —				
[5] pop-up = .120 7.1 cc				
1962 383 343 HP		66.5	– .023	Milling same as 73.5 cc heads above.
1962 361 305 HP		66.5	– .023	
1962 413 385 HP		66.5	– .023	
1962 413 394 HP		66.5	– .023	
440-4 (1977-78)		81.5	– .110 (.100)	
400-4 (1977-78)		81.5	– .050	

C. AHRA-IHRA Formula Stock

Formula Stock engines are basically quite similar to Super Stock engines except for compression ratio and carburetion. The carburetor can be any bore size or make. Changing the number of throttle bores will change the formula classification. Intake manifold and header usage is similar to a Super Stock engine.

The bearings, oiling system and engine clearances for the Formula Stock engine are the same as for a Super Stocker. The rest of the short block should be standard production except for the H.D. rod bolts and the pistons and rings. The recommended piston is a 11.5 to 12.5 forged racing piston (Lightweight) with either Dykes or 1/16 straight Moly-faced rings.

The camshaft selection is determined by the "Formula". A Formula One or Two engine should use the CD R286-500-08 P4007279, while the Formula Three (two-barrel carbs) should use the Crane R280-466-8. The Gold Box is the recommended best ignition system with the wide gap plugs.

The Formula One and Two "B" engines should use the 2" x 34" primary tube headers while the "RB" engines in these classes should use the 2⅛" x 36" primary headers. The Formula Three B & RB engines should use the next smaller size primary tube diameter.

The Stage IV H.P. cylinder heads (P4120352) are the best choice. However, the intake manifold selection is quite varied. The Formula One engines should use the Weiand Tunnel Ram. The Formula Two engines should also use the Holley (B or RB) four barrel version.

The Formula Three engines should all use the Holley (B-P4007937 RB-P4007938).

D. Super Modified

The NHRA super modified class is a very new group of engine modifications. A lot of dynamometer time hasn't been spent on the various B-RB engine combinations for this class. However, a few suggestions may be helpful.

NHRA has stated that the 361 and smaller B engines in the '67-69 A-Body cars are legal combinations in B/SM and C/SM. Also, the 383-400-440 engines in the '70 and newer Barracuda and Challenger are legal in A/SM. The 361 A-Body in B or C is a good choice. The big headers and CD R286-500 camshaft should be used. The real trick with these engines is the intake manifold. For the B-RB engines to be competitive with the big-port semi-hemis that are allowed in the same classes, the absolute best cylinder head is needed. This requires the big '62-64 max. wedge heads. Getting an intake to fit the engine that meets the rules is not easy. It can have no external modifications and cannot be homemade. The Holley is the desired choice or some similar piece.

It is important that the engine in each class be as small as allowed by the rules. The B and C engine could use a cut-down main 366 Hemi crank for a total displacement in the 361 block of 343 cu. in. For A, the 396 Hemi crank in either the 426 Wedge block or the 440 block would be the best with the resulting displacements of 396 (426W block) or 408 (440 block).

NHRA has minimum weights listed for each class which indirectly defines the minimum engine size. To be competitive the engine shouldn't be much bigger than the minimums allowed. In A/SM the minimum engine size is 394, in B it's 316 and in C it's 286. These are the best, most competitive engine sizes.

This means that the only "competitive" B engine would be a 394 in A/SM. The 318 (B/SM) and 286 (C/SM) are too small for the 'B' engine to get into. In A/SM it would have to run heads-up with the Hemis. While this isn't too great, it's a better deal than spotting another engine 300 to 400 pounds.

Keep in mind that the 383-440 engines are much *easier* and *cheaper* to build than the Hemi. It also has a much lighter piston and a better rod ratio than the Hemi.

E. Modified Production or Fully Modified

The fully modified engines tend to be very expensive to build which removes one of the biggest advantages of racing the B-RB engines which is low cost. Similar to the SM engines above, an MP engine should be kept as small as possible. The following chart gives some of the options available.

"B" BLOCKS

Bore x Stroke	
4.12 x 3.218 - 343 in.³	Cut down 366 Hemi Crank
4.25 x 3.218 - 364	Cut down 366 Hemi Crank
4.34 x 3.218 - 380	Cut down 366 Hemi Crank
4.12 x 3.38 - 361	Stock B engine Crank
4.25 x 3.38 - 383	Stock B engine Crank
4.34 x 3.38 - 400	Stock B engine Crank
4.12 x 3.48 - 371	Cut down 396 Hemi Crank
4.25 x 3.48 - 394	Cut down 396 Hemi Crank
4.34 x 3.48 - 411	Cut down 396 Hemi Crank

"RB" BLOCKS

Bore x Stroke	
4.18 x 3.218 - 354 in.³	366 Hemi Crank
4.25 x 3.218 - 366	366 Hemi Crank
4.32 x 3.218 - 378	366 Hemi Crank
4.18 x 3.48 - 383	396 Hemi Crank
4.25 x 3.48 - 396	396 Hemi Crank
4.32 x 3.48 - 408	396 Hemi Crank
4.18 x 3.75 - 413	Stock RB engine Crank
4.25 x 3.75 - 426	Stock RB engine Crank
4.32 x 3.75 - 440	Stock RB engine Crank

The rest of the engine pieces are quite straightforward. The CD R286-500 cam, tunnel ram and twin four barrel Holley's, the biggest headers 2¼" with the ported Stage IV heads, 13.5 to 1 compression ratio, Multi-Spark MSD7 or Gold Box crank trigger ignition and wide gap plugs. Oversize valves, especially intake should be considered but some flow work should be done before the exact size is selected.

The most important items in the open engine classes, like MP and Gas (8Bbl. tunnel ram, ported heads, any bore-stroke, etc.), are total car weight

and specific tire loading. Since all these open "modified" classes use the same size tire, the two items become the same. Therefore in the Altered and Gas classes the lightest car (i.e. smallest engine) will win. The engine size is determined by building the car absolutely as light as possible and then dividing the class break into the weight. For example if you build an A-engine Arrow at 1800# and you want to run A/G (5.5#in^3) then a 328 in^3 engine is built. If someone else builds a similar car for the same class 100# lighter and makes his engine smaller accordingly, he will win with equal execution. There is a physical limit as to how small an engine, especially big block 'B' engines, you can build and how light you can build the car.

.500 DOWN FILL VOLUMES (cc's) FOR 383-400-440 RACE ENGINES

383 in.^{3} 4.25 x 3.38 engine with .020 thick head gasket

Compression Ratio	383 Std. Bore		383 - .020 O/S	
	Head	Volume	Head	Volume
	80.0	74.0	80.0	74.0
10.5	114.3	120.3	116.1	122.1
11.0	110.2	116.2	112.0	118.0
11.5	106.4	112.4	108.2	114.2
12.6	103.0	109.0	104.7	110.7
12.5	99.9	105.9	101.6	107.6
13.0	97.1	103.1	98.7	104.7
13.5	94.4	100.4	96.1	102.1

400 in.^{3} 4.34 x 3.38 engine with .020 thick head gasket

Compression Ratio	400 Std. Bore		400 - .020 O/S	
	Head	Volume	Head	Volume
	80.0	74.0	80.0	74.0
10.5	122.6	128.6	124.5	130.5
11.0	118.3	124.3	120.1	126.1
11.5	114.4	120.4	116.2	122.2
12.0	110.8	116.8	112.6	118.6
12.5	107.6	113.6	109.3	115.3
13.0	104.6	110.6	106.3	112.3
13.5	101.9	107.9	103.6	109.6

440 in.^{3} 4.32 x 3.75 engine with .020 thick head gasket

Compression Ratio	440 Std. Bore		440 - .020 O/S	
	Head	Volume	Head	Volume
	80.0	74.0	80.0	74.0
10.5	130.0	136.0	132.1	138.1
11.0	125.3	131.3	127.3	133.3
11.5	121.0	127.0	122.9	128.9
12.0	117.1	123.1	119.0	125.0
12.5	113.6	119.6	115.4	121.4
13.0	110.3	116.3	112.1	118.1
13.5	107.3	113.3	109.1	115.1

F. Kit Car 'B' Engine

We have made two assumptions that our recommendations are based upon. First, that the racer will use a "junkyard" engine as a base because it's the cheapest approach. Second, that he use a 383-400 'B' engine rather than the 440 'RB' engine because the 'B' engine will be cheaper, more readily available and generate adequate horsepower. The RB (440) recommendations will be listed separately if they are different. The 440 may make too much power for the chassis-tire set-up.

1. **Starting Assembly** — One junkyard '62-71 383 or '72-'75 400 ('67-75 440)

2. **Block** — Stock piece is adequate. It isn't crossbolted, but this shouldn't cause any problems. The 383 blocks can be bored .060" while the 400 block should only be overbored .030". (The '67-75 440 can be bored .060".)

   The 'B' engine doesn't require any oiling fixes to the block. *If* the tappet bores are bushed which isn't required, then the first two bores on the *right side* should be left standard (#2 cylinder intake and exhaust lifter bores).

3. **Crankshaft** — Standard 383 crank should be adequate. The '62-71 383 had a six-bolt, forged crank, however, it isn't a full-radius crank. The majority of the 400 cranks are cast and externally balanced. Fully-grooved main bearings (alum.) are available from D.C. Hemi rod bearings can be used (The '67-74 440 crank is forged and can use Hemi main and rod bearings.)

4. **Connecting Rods** — The stock rods can be used with the high strength rod bolts and nuts (P4120068). They should be shot-peened and replaced occasionally. (440's should use the special 8640 rods - P3690649)

5. **Pistons and Rings** — Forged TRW 11.5 to 1 compression ratio honed pistons are available from D.C. in standard and oversize bores for both the 383 and 400 engines. Moly 1/16" top ring and low tension oil ring sets are available from D.C. (Same is true of the 440).

6. **Cylinder Head** — The standard head can be used. The '67 440 and the '68-74 B-RB heads are all good ones. The new D.C. Stage IV head is the best.

7. **Head Gasket and Bolts** — Production head gasket is best. It's .017" to .020" thick, steel. Standard bolts are fine but we recommend head bolt washers to keep from bottoming the head bolts.

8. **Valves** — Standard valves for the heads mentioned above are fine. They are all 2.08" Intake and 1.74" Exhaust. The D.C. has premium 2.08" Intakes P3690708 and 1.74 exhausts P3690709. They also have a 2.14" nail-head intake valve P4007942 for the racers with "sharp" motors. All kit car engines should have the valves backcut. The valve should not be sunk for any reason past what it takes to get a good seat.

9. **Valve Springs** — The majority of applications will use the Green Spring P2806077. The over —.620" — lift cams will have to use something else — possibly P2946353 installed at 2.000".

10. **Valve Spring Retainers** — The old Hemi Grand National retainer 3577325 should be best. Otherwise the Apollo Titanium retainer P4007245 would be recommended (10 degree system also recommended.)

11. **Valve Stem Locks** — "Keepers" — The D.C. hardened pieces are recommended. The production pieces may be acceptable. For best setup use new 10° keeper retainer setup.

12. **Rocker Arms** — The standard production steel adjustable rockers are best. Eight right PN 2463242 and eight left PN 2463243 are required. Complete package PN P4120974.

13. **Rocker Shaft** — Standard 2465850 is fine. Must be installed with the oiling hole toward the exhaust flange. Newer shafts ('74-78) are not as good as the older shafts.

14. **Rocker Shaft Spring** — PN 2202557 is required to keep adjacent rockers separated. Four required per head.

15. **Pushrods** — Standard early production PN 2402035 (B) are fine and ready made. (RB-2402326). The D.C. pushrod kit P4007284 could also be used.

16. **Mechanical Tappets** — Standard mechanical (Hemi) tappets P2843177 could be used. However the mushroom lifters P3690137 are recommended because of the cam designs that are to be used. (Can only be used with mushroom cam designs however.) A back-spot facing tool and bushing should be used to back-spotface the underside of the lifter bores.

17. **Camshaft** — A mechanical flat-tappet is recommended. Currently there are two camshafts that can be used that should be considered. They are the D.C. 590 P4120663 (.590 lift) and the Chrysler mini-express PN P3690588 (.654" lift).

18. **Timing Chain & Sprockets** — Same as Hemi — roller pieces best, chain P3690279 crank sprocket P3690280, 1 bolt cam sprocket P3690277, 3 bolt cam sprocket P3690278.
19. **Covers and Bolts** — Production valve covers, timing covers, head bolts etc. are fine.
20. **Intake Manifold** — Assuming a single four-barrel carburetor, the Holley Dominator P4007937 (B) is best. (RB-P4007938)
21. **Oiling System** — Same as Petty Hemis from early days or Dry Sump.
22. **Headers** — The 426 Wedge Grand National engine used 2¼ x 36 headers. For kit car racing with the 383-400 we'd recommend 2 x 36 (2⅛ x 36 — 440).

G. NASCAR-Grand National (For reference)

This is no longer a legal engine package for Grand National racing and is included for reference only.

The only wedge engine used on the Grand National circuit is the 426 cubic inch version because of various rules and restrictions — i.e. the 440 is too big and the 383 and 400 are too small. The 383, 400, and 440 engines may be used in other forms of circuit racing by following a similar procedure to the 426. Because of frequent changes, the carburetor and restrictor plates will not be covered.

The 426 engine uses the 426 Marine Block PN 3690030. The 426 Hemi block could be used if the upper row of head bolt holes are relocated. Relocating these holes entails filling in the Hemi bolt holes and drilling and tapping new holes to accept the wedge cylinder head. This procedure can be done to enable the cross-bolted Hemi block to be used with the wedge heads.

The cylinder heads are standard production 400 or 440 heads from 1971 or 1972 PN 3462344. These heads should be ported by Petty Enterprises or another good porting service, but the stock valve sizes (2.08" dia. intake and 1.74" exhaust) should be kept. (Consider 2.14" dia. intake and 1.01" exhaust for maximum power high speed ovals.)

The NASCAR racing crankshaft PN 3462279 is a full-radius Hemi crank with a 3.75" stroke and the provision for the dry sump oiling system. The main bearings that are used are tri-metal F-77 PN2836118 and the main bearing clearance is .002" to .003". The rod bearings are also tri-metal F-77 PN2525484 and the rod bearing clearance should be .002" to .003". The crankshaft end play should be .0025" - .005" as installed. Once the crank end play exceeds .009", the #3 main bearing should be replaced.

The NASCAR Hemi connecting rods PN P2531277 are used in the 426 wedge. These rods have a center-to-center length of 7.061" and a piston pin diameter of 1.094". Since these rods are longer than the standard rod, special 12.5 to 1 pistons are required. The standard bore size piston is PN 3614461. The piston-to-wall clearance is .007" - .008".

These pistons are a Dykes type ring, that is, Moly-filled and are sold separately — top PN 2532168, 2nd PN 2468957, rail PN 2468133 and spacer PN 2532701. These are all standard bore sizes, but .020 oversize pistons and rings are also available. The piston ring end gap should be .017" - .018". The moly rings required a very smooth hone finish — 10 to 15 micro.

The piston pin has a 1.094" diameter and has a clearance of .007" - 0.010" pin in piston, .009" - 0.014" pin in rod. The piston pin end clearance should be 0 to .005". The pin locks are double Tru-Arc.

Both the intake and exhaust valves are the single lock groove design. The intake valve PN-3614440 is a stock 2.08" diameter and the exhaust valve PN-3614444 is also the stock 1.74" diameter. The valve-to-piston clearance should be .100" on both the intake and exhaust valve. The valve springs are PN-3690198 and should have an installed height of 1.86" - 1.91". The valve seals used are perfect circle.

The cylinder head volume generally used is approximately 80 cc and a compression ratio of around 12.0 is general practice. The piston-to-cylinder head vertical clearance should be .070" minimum. The pushrods used are PN-2402326 and standard "B" engine mechanical rocker arms. The cam sprocket, crank sprocket and timing chain are the standard Hemi roller equipment. The valve spring retainers are PN-3577325.

The camshaft is usually selected by the type track that the car is being raced on.

Track	Camshaft	Valve Lash Intake	Valve Lash Exhaust
Short Track	STX-22 Racer Brown	.020"	.024"
Long Track	STX-24 Racer Brown	.028"	.032"
All	Chrysler 436 P3690588	.024"	.028"

The Chrysler design is a good all-around camshaft but it *requires* .100" oversize mushroom tappets PN-3690137.

The NASCAR intake manifold for the single 4500 Holley carb is a two-piece aluminum design — bottom PN-2531959 and top or cover PN-2531690.

A steel head gasket PN-3614824 is being used which is approximately .020 thick when compressed. The Hemi crankshaft vibration damper PN-2532202 is used. The TDC mark with this damper should be checked with a dial indicator during engine assembly. The special Hemi mechanical fuel pump PN-2532176 should be used.

The ignition system is the new Chrysler mag-trigger electronic ignition which uses a special distributor PN P3690202. The distributor drive shaft is PN-3512110. The total spark advance should be set at 38-40 degrees total BTC.

The headers should be 2¼" diameter and 36" length primaries with a 3" collector and an 'H' pipe located 12" to the rear of the beginning of the collector pipe (not the transition).

Circuit Racing wedge engines should use a dry sump oiling system. The following list of parts is required to install the dry sump oiling system on a race car. No hoses or oil pan pickups are included.

NASCAR GRAND NATIONAL COMPRESSION RATIO CHARTS

426 in.³ 4.25 x 3.75 engine with .020 thick head gasket

.500" Down Fill Volume cc	Cylinder Head Volume — cc 87.0	85.0	83.0	81.0	78.0	75.0
113.5	10.75	11.00	11.25	11.50	12.00	12.50
111.5	11.00	11.25	11.50	11.75	12.25	12.75
109.5	11.25	11.50	11.75	12.00	12.50	12.00
107.5	11.50	11.75	12.00	12.25	12.75	13.25
105.5	11.75	12.00	12.25	12.50	13.00	13.50
103.5	12.00	12.25	12.50	12.75	13.25	
102.0	12.25	12.50	12.75	13.00	13.50	
100.5	12.50	12.75	13.00	13.25		
99.0	12.75	13.00	13.25	13.50		
97.5	13.00	13.25	13.50			

426 in.³ .020 oversize 4.27 x 3.75 engine with .020 thick head gasket

.500" Down Fill Volume cc	Cylinder Head Volume — cc 87.0	85.0	83.0	81.0	78.0	75.0
115.5	10.75	11.00	11.25	11.50	12.00	12.50
113.5	11.00	11.25	11.50	11.75	12.25	12.75
111.5	11.25	11.50	11.75	12.00	12.50	13.00
109.5	11.50	11.75	12.00	12.25	12.75	13.25
107.5	11.75	12.00	12.25	12.50	13.00	13.50
105.5	12.00	12.25	12.50	12.75	13.25	
104.0	12.25	12.50	12.75	13.00	13.50	
102.5	12.50	12.75	13.00	13.25		
101.0	12.75	13.00	13.25	13.50		
99.5	13.00	13.25	13.50			

Part	Part No.
Oil Pressure Pump	PE-71148
Oil Pan — Dry Sump	3462219
Baffle	NC-69015
Reservoir Tank	PE-71057
Oil Filter	2531452
Adapter	2531453
Scavenger Pump Complete (less drive sprocket)	PE-71050
Scavenger Drive Sprocket	3418739
Key	18768
Crank Drive Sprocket	3418740
Key	124549
Drive Chain	3418738

If the sanctioning body does not allow a dry sump, there are stampings available from which a good wet sump can be made:

Bottom Stamping	PE-71154
Top Stamping	PE-71155
Flange	PE-71156

H. Truck Pulling

There are many different places for the B-RB engines to be used in truck (tractor) pulling. It was installed in 2WD and 4WD trucks and vans in one form or another for many years. However there are too many different rules under which the engine can compete that a specific engine package can't be spelled out exactly.

As a general rule "pulling" engines want more *torque*, not necessarily more horsepower. Mild to intermediate hydraulic cams or the .528" short D.C. mechanical cam with wide valve lash would be best. Headers smaller in diameter and longer like 1⅞ by 42 instead of 2 x 36 would be recommended. A bracket valve job is a good performance tip. A recurved distributor and D.C. ignition is also recommended.

From here we would recommend chassis modifications. An automatic transmission with a Turbo-Action manual control valve body P4007291 should out-pull a manual transmission. We would also recommend a higher stall, hi-torque multiplication torque converter P2836977. An even higher stall converter like the T-A 3800 P4007290 would be used if larger cams were selected.

IX.
BUILDING FUEL ECONOMY

Most of the parts that are changed for better engine output will hurt the same engine's fuel economy. Blueprinted engine (short block) helps both but is expensive to do for only fuel economy reasons. The exhaust system (duals, headers etc.) *usually* help both (performance and fuel economy) but headers *can* confuse the carburetor causing poorer fuel distribution and the resulting poorer economy. This aspect of headers cannot be predicted in advance. Ignition reworks such as recurving the distributor and setting the total spark advance will also help both aspects up to the point at which the available pump gas causes detonation. A good valve job is highly recommended as is a bracket valve job and bronzewall valve guides if the heads are used (i.e. not brand-new).

From this point, having done the above modifications, it is a tradeoff — more fuel economy, less performance and vice-versa. If more fuel economy is desired and giving up performance is acceptable, then smaller camshafts (less lift) especially with less overlap are the areas in which to look.

X.
GENERAL CHASSIS

The Chassis recommendations for bracket racing are listed in the Direct Connection Catalog with the engine tips. Refer to the specific chassis Bulletins such as rear suspension (#30) or specific class Bulletins such as Super Stock (#33) for more chassis details. All are included in companion book P4286520.

XI.
ADDRESS

For other technical-racing bulletins referred to in this manual, contact your local Direct Connection dealer, or Direct Connection Speed Shop Outlet. For the complete set of Bulletins, order the Bulletin Books P4286519 Engine & P4286520 Chassis or write to:

Direct Connection Catalog Center
20026 Progress Drive
Strongsville, Ohio 44136

Special Note 1:	Many part numbers listed in the manual are given for reference. They may not be currently available.
Special Note 2:	The information listed in this manual is more up-to-date than any other recommendations. Therefore this manual supersedes all previous "B-RB" engine bulletins.