and engine performance will be affected—possibly to the extent of the pistons hitting the cylinder heads! Let's see how this works.

With a given crankshaft, if you install a longer rod, the piston will operate higher in its bore. Conversely, a shorter rod will move the piston lower in its bore. Fortunately, the job is simplified on small-block Chryslers. The connecting rods are all the same length and different-stroke crankshafts will not interchange. But these same circumstances apply equally to piston *compression height*—distance from the piston-pin-bore center to the flat surface around the top of the piston.

When compression height is increased, the distance between piston pin and the piston top is increased. Therefore, the top of the piston operates higher in its bore. Reducing compression height lowers where the piston operates.

The final consideration is *deck clearance*—the distance from the top of the piston at TDC and the block's deck surface. These specifications must be kept in mind when considering a swap.

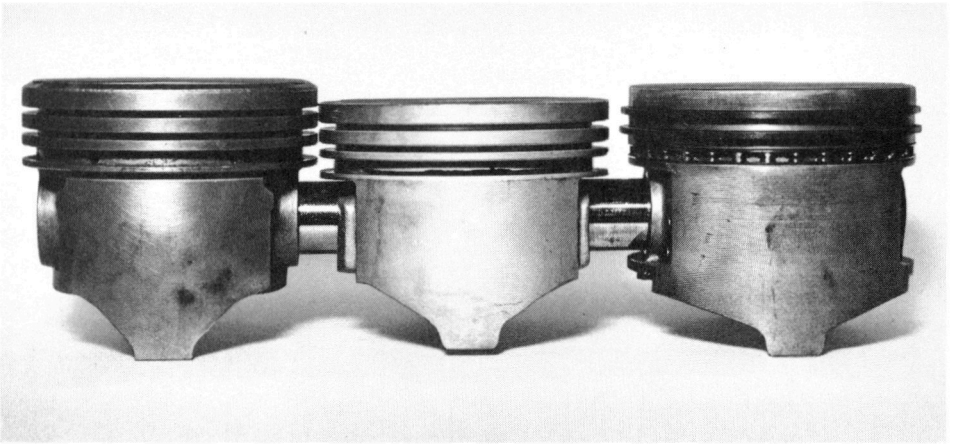
Never arbitrarily change crankshaft throw, connecting-rod length, piston compression height or deck clearance!

Your final consideration in the bottom-end-interchange process is *balance*. You'll remember from the rod discussion that using a heavy-duty rod to replace a light-duty rod changes engine balance. As a general rule, any interchange of lower-end parts should be finished off by balancing at your local engine machine shop.

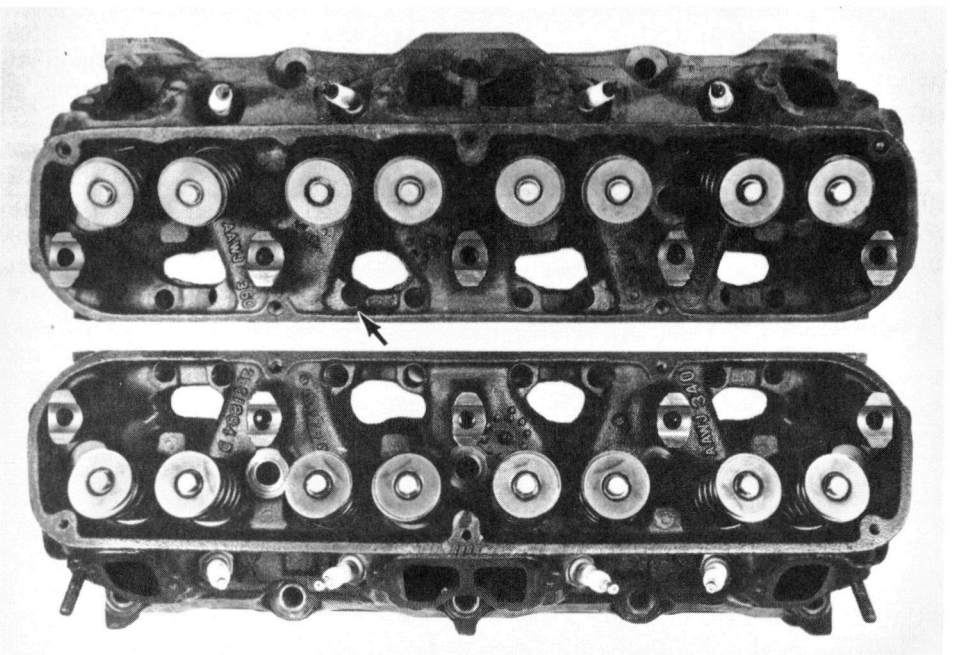
CYLINDER HEADS

At first glance it appears obvious that all small-block heads should interchange on all small blocks. In fact, they will—sort of. They'll bolt on, but this doesn't mean they'll work properly. Over the years, Chrysler has made many head, valve and valve-train changes. This was due to both performance and government emission-control requirements. Before getting into specifics, let's look at some design fundamentals.

First, we'll consider compression ratio. Two terms must be understood—*top dead center* (TDC) and *bottom dead center* (BDC). TDC is the highest position the piston reaches in its upward travel. BDC is the opposite, or lowest position reached.



Left to right: 340 high-compression, 360 and 318 pistons. Compression height, or distance from the center of the piston-pin bore to piston top, establishes deck clearance and raises or lowers compression for a particular stroke.



At first inspection these heads appear to be interchangeable. Although they will bolt on each other's block, they won't work. Bottom head is a standard 340. Note casting number AAWJ 340 on intake runner at far right. Top head is a TA340 head, with pushrod holes located farther from the intake runners (arrow).

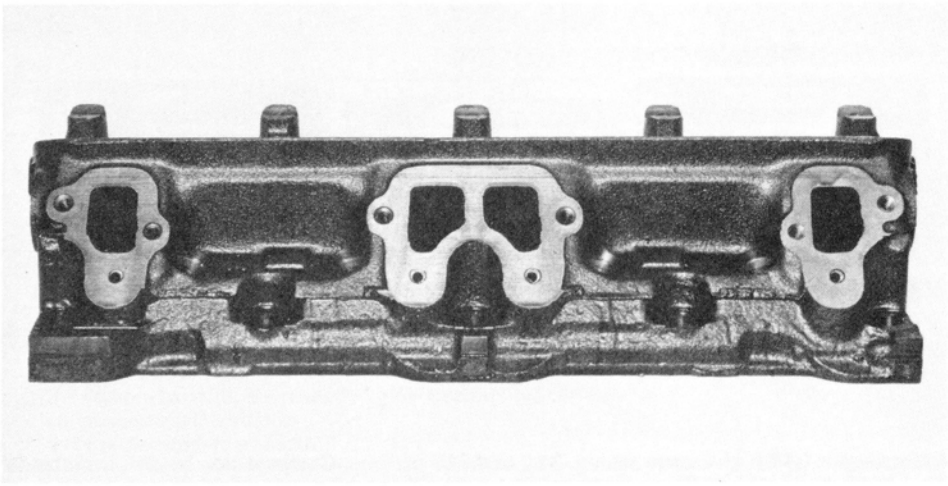
The idea with this one-year-only head (1970) was to allow the high-performance modifiers to remove more material from the intake ports. TA340 head was originally a 360 casting. Notice the AAWJ 360 casting number on far left intake port. TA340 was the first engine to use this casting, because the 360 was not released until one year later. When identifying a part, be sure you use physical descriptions as well as casting numbers.

As a piston travels from BDC to TDC, it *sweeps* through, or displaces, a volume called *swept volume* (SV). Swept volume is a cylinder's displacement.

A cylinder's compression ratio is *directly proportional* to its *swept volume* or *displacement*, and *inversely proportional* to its *clearance volume:* CR=SV/CV+1. In simple terms, increasing swept volume increases compression ratio, but increasing clearance volume decreases compression ratio.

The compression-ratio formula says that as an engine's displacement is increased, clearance volume must also be increased to maintain the same compression ratio. That's why oversized pistons are manufactured to increase clearance volume by a smaller-than-original dome or larger-than-original dish. Otherwise compression ratio would be increased.

This is an important consideration when interchanging heads. With today's fuel, compression ratios over 8:1 can cause detonation. If detonation



Air-injection ports are just below exhaust ports. Head can be used on an engine not equipped with air-injection if the four small ports are plugged.

is severe, engine damage will occur. With stock high-compression engines (10.5:1), this has already become a problem. At the same time, changing to a head with a too-large combustion-chamber volume will result in a low-compression, poor-performing engine.

Other head-design factors affecting performance are valve and port sizes.

If these are too small the engine won't breathe properly and will lose power. In other words, the engine cannot draw an adequate air/fuel mixture through the smaller valve and port openings. On the exhaust stroke it will be unable to expel the exhaust efficiently.

If the valves and ports are too large—particularly on the intake side—the air/fuel mixture will not have enough velocity to keep the fuel mixed with air at low rpm. This creates poor driveability and low-speed sluggishness.

There is a good rule-of-thumb: With an otherwise-stock engine, keep the valve sizes within ±10% of engine specifications.

CYLINDER-HEAD EVOLUTION

You may be interested in the evolution of the LA-line cylinder heads.

273—Manufactured from 1964 to 1969, these small-port heads incorporate 1.78-in.-diameter intake valves and 1.50-in. exhaust valves. Stem diameters are 0.3725 in. (intake) and 0.3715 in., (exhaust). These valves are retained with four-groove keepers.

Shaft-mounted forged-steel rocker arms are used with solid—not hydraulic—lifters. The rocker arms are adjustable with interference-fit screws for locking. The combustion chamber is the smallest of the entire series at about 57cc (cubic centimeters).

318—When the LA-series 318 was introduced in 1967, it used the 273 small-port head. In 1968 the combustion-chamber volume was increased to 60cc. In 1972 the chamber volume was increased to 61cc to lower compression. In 1973, Chrysler enlarged the exhaust-manifold mounting surface to accommodate air-injection ports. In 1975 the combustion chamber was enlarged to 63cc, and retains this configuration to the present.

Note—The '55—'66 A-series 318 with the *polyspheric* combustion chamber is essentially a different engine. Although the block, crankshaft and other lower-end parts will interchange, the heads use an entirely different valve layout with semi-canted valves and solid lifters. Heads, camshaft and valve-train components will not interchange with later 318s.

340—Introduced in 1968, the 340 uses larger ports, 2.02-in. intake valves and 1.60-in. exhaust valves. Valve-stem diameters remain the same as the 273/318. The forged-steel rocker arms and solid lifters of the 273 were replaced by stamped-steel rockers using hydraulic lifters.

TA340—For one year, 1970, Chrysler manufactured a special 340 engine for the T/A Challenger and the AAR 'Cuda, called the TA340. Heads for this engine were machined from the standard castings, with pushrod holes angled away from the intake ports. Although the ports themselves were unchanged, this single machining change made it possible to remove more material in the pushrod-hole area of the port than was possible with the standard 340. Enlarging the ports for increased airflow was strictly a high-performance modification.

Normally, the rocker arm is perpendicular to the rocker shaft. Because the intake-pushrod holes on the TA340 were relocated, it became necessary to design an offset rocker arm. Looking from the exhaust-port side of the head, numbers 1, 4, 5 and 8 are offset to the left and 2, 3, 6 and 7 are offset to the right. All eight exhaust rockers remain perpendicular (90°) to the shaft. Hydraulic lifters are adjusted with an adjusting screw and locknut. See photo, page 50, to compare rocker-arm assemblies.

360—When the largest of the LA line, the 360, was introduced, several modifications were incorporated. Intake-valve size was reduced to 1.88 in. The 1.60-in. exhaust valve was retained. Valve-stem diameters remained 0.3725 in. for intake and 0.3715 in. for exhaust.

The original 62cc chamber volume was increased in 1972 to 64cc. In 1973, the exhaust-manifold mounting surface was enlarged to accommodate air-injection ports.

Other Considerations—When interchanging heads on '73 and later engines you must consider whether or not an air pump will be used. Using an air pump requires heads designed for air injection.

The swap works very nicely the other way, however. If you wish to use a head with air-injection ports and you don't need them, plug them. The holes in the exhaust manifolds are tapped with 1/4-in. NPT threads. Be sure to use either brass plugs or bolts with high-temp gasket sealer on the threads.

Nine different cylinder heads have been used on LA engines since their beginning in 1964. Of these nine, there are only three valve combinations—one for the 273/318 with 1.78-in. intake and 1.50-in. exhaust; one for the '68—'71 340 with a 2.02-in. intake and 1.60-in. exhaust; and finally, one for the 360 and '72-'73 340 with 1.88-in. intake and 1.60-in. exhaust.

Pay special attention to the intake-manifold bolt holes if you are rebuilding a '64 or '65 273. These holes are at a different angle than on the other LA-series heads. If you are working with the 1970 TA340 with the 3x2-barrel carburetors, note that the push-

CYLINDER-HEAD CASTING NUMBERS AND SPECIFICATIONS

Engine	Year	Casting Number	VALVE SIZES (in.) In.	Ex.	Combustion-Chamber Volume (cc)	Rocker-Arm Type
273	64-65	2465315	1.78	1.50	57	Adjustable
273	66	2536178	1.78	1.50	57	Adjustable
273	67	2658920	1.78	1.50	57	Adjustable
273	68-69	2843675	1.78	1.50	60	Non-adjustable
318	67	2658920	1.78	1.50	57	Non-adjustable
318*	67	2658234	1.78	1.50	57	Non-adjustable
318	68-71	2843675	1.78	1.50	60	Non-adjustable
318	72	2843675	1.78	1.50	60	Non-adjustable
318	73-74	2843675	1.78	1.50	60	Non-adjustable
318	75-76	3769973	1.78	1.50	63	Non-adjustable
318	77-80	4027163	1.78	1.50	63	Non-adjustable
318	77-80	4027593	1.78	1.50	63	Non-adjustable
340	68-71	2531894	2.02	1.60	63	Non-adjustable
340TA	70	3418915	2.02	1.60	65	Adjustable**
340	72	3418915	1.88	1.60	65	Non-adjustable
340	73	3671587	1.88	1.60	65	Non-adjustable
360	71	3418915	1.88	1.60	65	Non-adjustable
360	71	3418915	1.88	1.60	65	Non-adjustable
360	73-74	3671587	1.88	1.60	65	Non-adjustable
360	75	3769974	1.88	1.60	65	Non-adjustable
360	76	3769974	1.88	1.60	65	Non-adjustable
360	76	3671587	1.88	1.60	65	Non-adjustable
360	77-80	4027596	1.88	1.60	66	Non-adjustable
360	77-80	4071051	1.88	1.60	66	Non-adjustable

Each casting can be machined differently, so use casting numbers as a guideline only. Use the physical features of the part for final identification.

***Used only on 1967 trucks with water-heated intake manifolds. This head will interchange with other 318 heads only if water-heated intake manifold is used.**

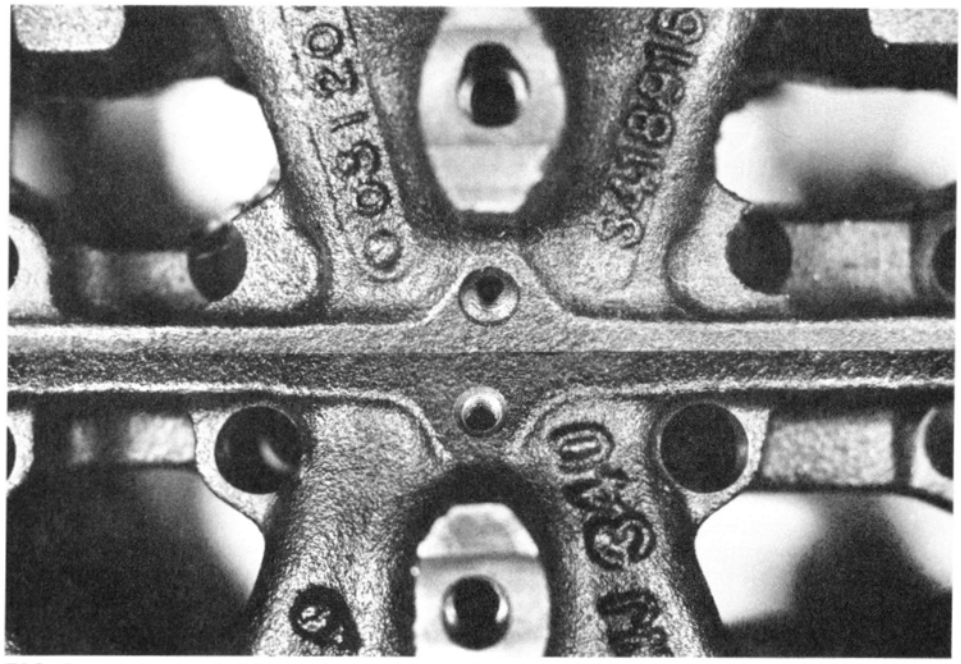
****Uses cast rocker arms with adjustment screws and locknuts. Intake rocker arms are offset left or right. Early 273 uses straight rockers locked with interference-fit screws.**

rod holes have been relocated due to the unique valve train. These heads are hard to find, either new or used.

You might run into some confusion if you're dealing with early model 340 heads, casting 2531894. This head has been replaced by the 360 cylinder head, casting number 3418915, which is machined to 340 specifications. This 360 head is identical to the early 340 in port size and shape, valve size, and combustion-chamber volume. Despite the different casting number, it is sold under the early 340 part number 2531894.

Some interesting swap combinations are possible. The '71—'80 360 uses a 1.88-in.-diameter intake valve. This valve can be replaced with the earlier 340 2.02-in. intake valve 3690230 by simply regrinding the seat.

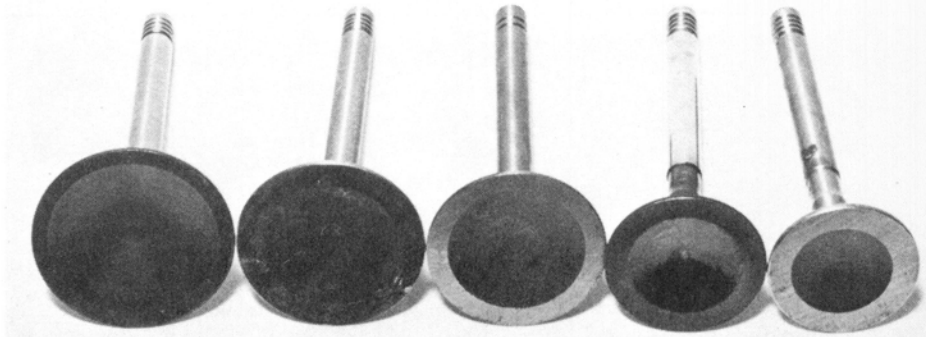
The 1970 340 cylinder head will fit the 318, leaving a 0.080-in. clearance between the valve and the cylinder wall. This is close but adequate. If you want to use 340/360 heads on a 318, be sure to use either a 340 or 360 intake manifold to take full advantage of the larger ports in these heads. Keep in mind that the larger valves and ports on this combination will hurt low-rpm performance, so unless you're serious about high-rpm breathing, stick with the stock heads and manifold.



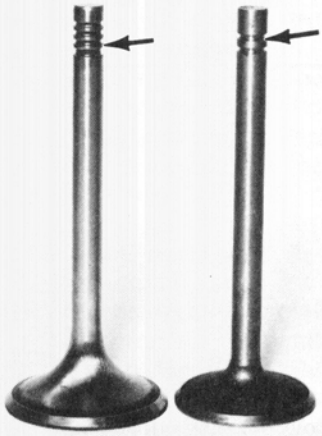
TA340 and standard 340 heads with their intake-manifold surfaces butted together show how one casting can be machined differently to fit different applications.

Pushrod type is another consideration when swapping heads. The '64—'67 273 uses solid lifters with adjustable rockers. Other engines use hydraulic lifters and non-adjustable rockers with the exception of the TA340. This engine uses hydraulic lifters and adjustable rockers. Pushrod types should not be intermixed. See the chart on page 51.

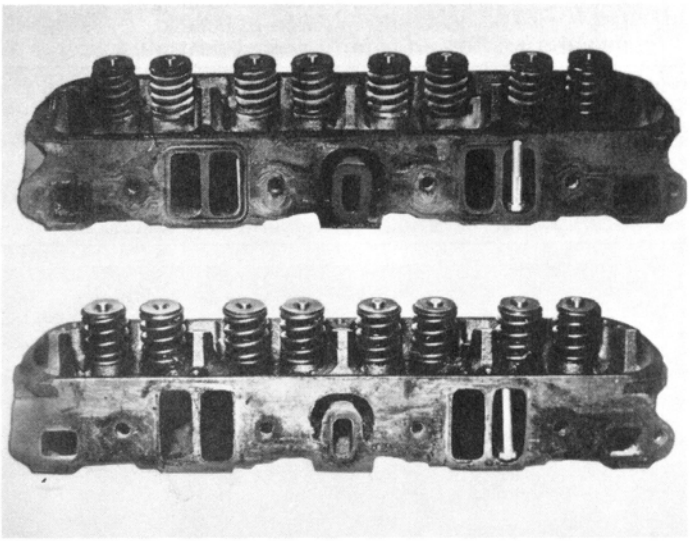
Be careful when using heavy-duty



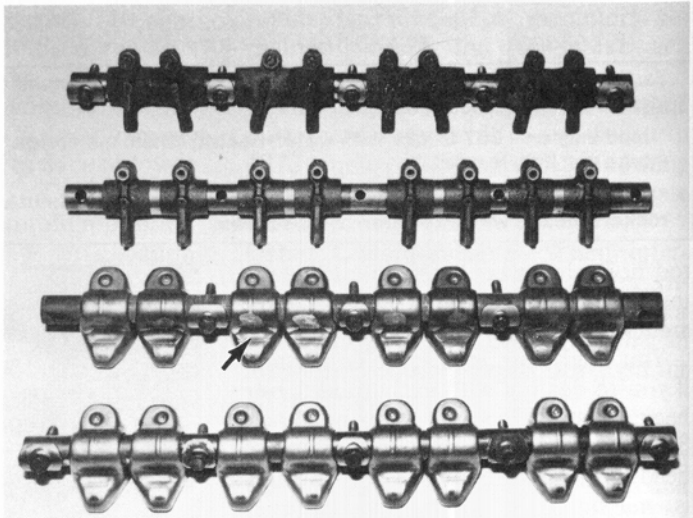
Five valves represent entire LA line. From left to right: 340 2.02-in. intake, 360 1.88-in. intake, 273/318 1.78-in. intake, 273/318/1.50-in. exhaust, 340/360 1.60-in. exhaust.



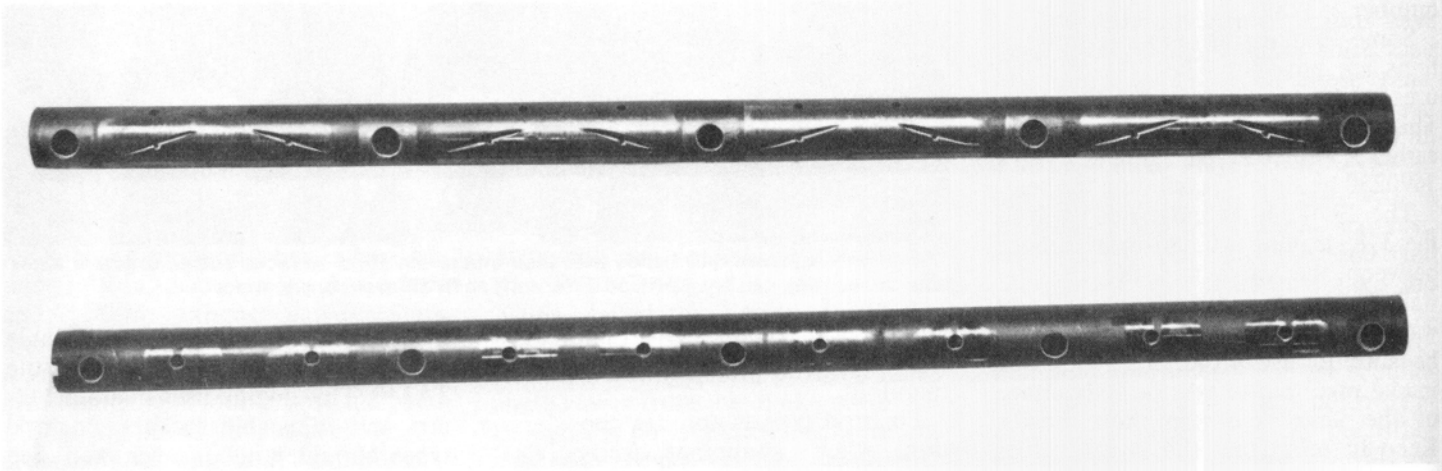
Be careful not to confuse four-groove-keeper valves with two-groove-keeper valves. They will interchange only if you use the corresponding keepers.



Small intake ports of 273/318 at top contrast with the large ports of 340 head at bottom. Bolts standing in intake ports are the same length.



Complete LA line of rocker-arm assemblies. Top to bottom: TA340 (note offset intake rocker arms), 273 adjustable, standard 340, and 273/318/360 standard. Grinding on 340 (arrow) gives clearance for slightly larger valve springs.



Compare TA340 rocker-arm shaft at top with stock 273 shaft. Both use adjustable rockers. Note grooves on TA340 shaft to distribute oil evenly to rocker fulcrums.

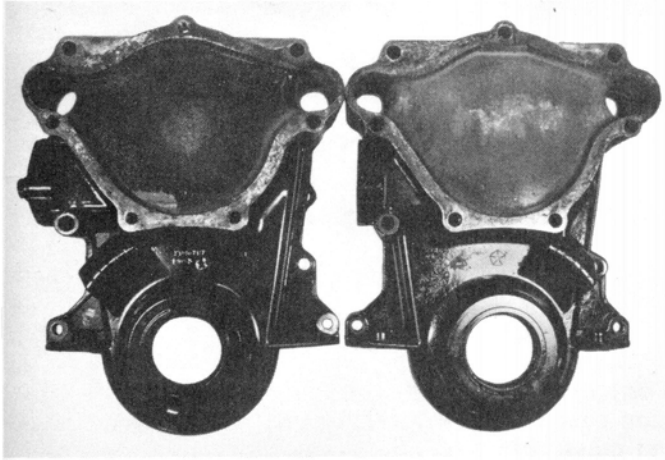
PUSHROD SPECIFICATIONS

Year	Engine	Type	Pushrod Ends†	Pushrod Part Number	Pushrod Length (in.)	Diameter	Style
64—67	273	(2)	B&S	2465343	7-11/32	5/16	hollow
68—69	273	(1)	B&B	2899561	7-31/64	9/32	solid
67—80	318	(1)	B&B	2899561	7-31/64	9/32	solid
68—80	340/360	(1)	B&B	2899567	7-31/64	9/32	solid
71	340 TA	(3)	B&S	3577121	7-1/4	5/16	hollow
All*	All*	(2)	B&S	70174	7-5/32	5/16	hollow

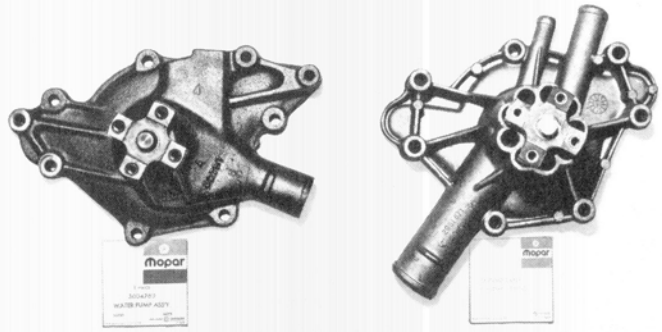
(1) = Hydraulic lifters, non adjustable rockers
(2) = Solid lifters, adjustable rockers
(3) = Hydraulic lifters, adjustable rockers
†B = Ball, S = Socket

*** Conversion from hydraulic to solid lifters.**

This chart will help you identify pushrods and gives part numbers in case you need to replace one. If you plan to convert your engine to solid lifters with adjustable rocker arms, use the last line of information. Note that the conversion pushrod has a different part number and different length.



Pre-'71 timing-chain cover on left interchanges with the one on the right, but timing marks will be 90° off! You'll also need the correct damper to match the marks.



Two water pumps represent the only styles used in the LA line. Cast-iron pump at left is used on '64—'71 engines. Aluminum pump at right was introduced in 1972 as the standard pump. Interchanging water pumps requires changing the timing-chain cover and crankshaft damper, and relocating the radiator outlet to the right side.

pushrods. TRW provides a very nice heavy-duty pushrod kit using 3/8-in.-diameter tubing; OEM is 5/16 in. Therefore, the larger-diameter pushrod will bind in the cylinder-head hole. This however, is easily corrected by filing the holes at the interference points.

Mopar's pushrod kit 4007284 provides pushrods that can be cut to length. The kit includes 16 rods, 32 hardened tips and a fixture to hold the pushrod while pressing in the tip. Couple this with 273 adjustable rockers and you will be able to adjust your hydraulically actuated valves.

IGNITION

Within their classifications—single-point, dual-point and electronic—all distributors used on LA engines are interchangeable.

Be aware that distributors are *calibrated* differently for specific engines, even though they are mechanically interchangeable and appear the same. Consequently, if you arbitrarily change distributors or distributor components, your engine's performance can be dramatically altered. Power will be reduced if total spark advance is not sufficient or timed right, or you may end up with a detonating engine if there's too much advance. A good ignition specialist can modify a distributor to the specifications for your engine.

The single-point and electronic distributor housing is cast aluminum while the dual-point is cast iron. Pre-'68 distributors seal to the block with a gasket, while '68 and later use an O-ring.

The 2-barrel 273, 318 and 360 engines used a single-point distributor until 1973, when electronic ignition became standard.

Some late-'72 318 and 360 engines are equipped with electronic ignition. The 340 has used it since mid-1971. The the '68—'71 340 and 235-HP 273-4-barrel engines have a dual-point distributor with a cast-iron housing.

Consider these differences when swapping distributors. Remember, breaker-point and electronic distributors are interchangeable only if the complete ignition system is changed.

WATER PUMP & FRONT COVER

All LA engines use an aluminum timing-chain cover to which the water pump mounts. There are three types.

From '64—'68, covers were cast without timing marks. A sheet-metal plate fastens to the cover with the two bottom water-pump bolts. In '69—'70, the timing marks were cast into the timing-chain cover. In 1971, the timing marks moved from the right to left side of the cover to accommodate a new water pump.