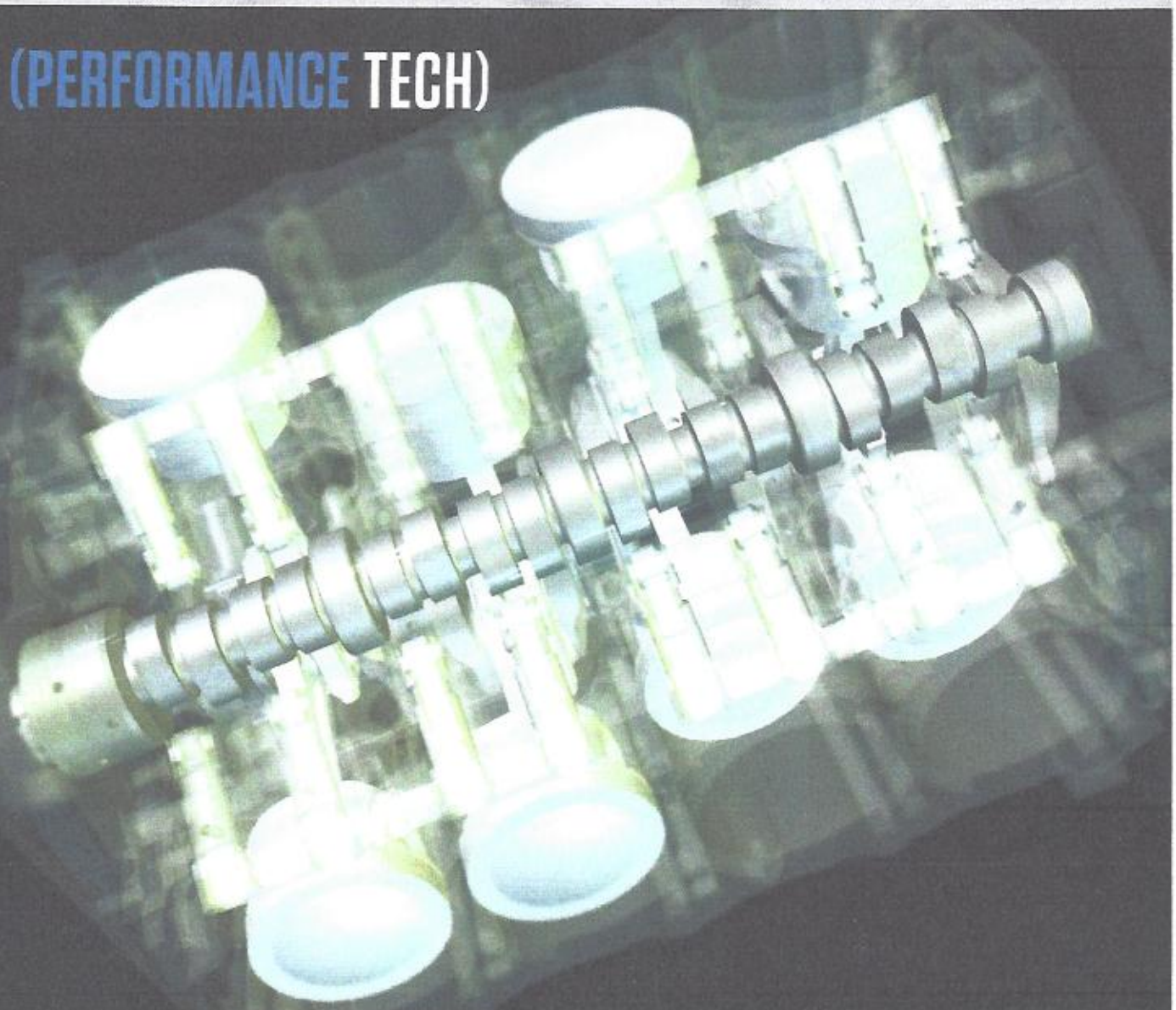


MOPAR® HIGH-PERFORMANCE CAMSHAFTS

WHAT TO CONSIDER IN THE SELECTION PROCESS

WORDS LARRY SHEPARD

The camshaft's main function is to open and close the cylinder head valves via the valvetrain. That makes it pretty important to the engine's overall performance. Sometimes, in building or planning an engine, the camshaft is selected early, and sometimes it is selected late or even last. There are thousands of cams to choose from and it is much easier to get the wrong one than it is to get the right one! There are too many variables in this selection process to cover completely in this short article, so we'll limit the discussion to dual-purpose engines, perhaps street and mild strip.

FIRST, LIST THE SPECS

Selecting a specific cam design for your engine means that you will need to list the cam's specifications – lift, durations, centerlines, overlap and physical dimensions like length, journals, spacing, tappet angles and oiling. Most of these physical dimensions are covered by defining the engine – A-engine small block, B/RB engine big block or 426 HEMI® Gen II, etc.

The lift and duration aspect of the cam design is a function of the lobe profile. This lobe profile is generated from a lift table. The lift table is generated from a very high-powered mathematical equation. The profile yields lift and calculates velocity (how fast the tappet/valve is moving) and acceleration (how fast the velocity is changing). These parameters allow the cam designer to make a cam that works for the customer. Cam designers know that if the velocities and accelerations get too high, the cam could cause problems.

THE TAPPET & CAM MUST BE MATCHED

No single cam is best for every group of hardware that makes up a complete engine package/assembly. Once you settle on an engine, there are some basics that can help narrow the selection process. Perhaps the first aspect to consider is the tappet – hydraulic or mechanical. This could also mean mechanical roller or hydraulic roller. The mechanical roller is only used in racing, so we won't discuss that aspect.

The tappet and the cam must be matched and are usually purchased together as a kit. The deciding factor might be the valvetrain or, more specifically, the rocker arms. The mechanical tappet requires an adjustable rocker arm. If you're using a stamped rocker arm (like most production engines) then you will have to stay with a hydraulic cam.

The hydraulic "roller" cam and tappet began being used in production engines in the late 1980s in the small block. It was used on all Magnum® engines (5.2L/5.9L) beginning in 1992. This system doesn't fit the earlier A-engine or any B/RB engine because there are no bosses in the tappet chamber to hold the guide-bar hardware that keeps the tappets from rotating. Aftermarket cam manufacturers make kits to allow the hydraulic roller cams to be used in these older engines (A-engine and B/RB/426 HEMI big blocks).

VALVE SPRING CONSIDERATIONS

The next aspect to consider is the valve spring. The valve spring and the cam lift must work together. If you can't change the spring, then you will have to limit the valve lift. For example, one of the best overall street cams for the Chrysler small block is a 280-degree, .474-inch lift hydraulic cam. This cam uses the HP valve spring *P4120249 originally developed for the HP 340 package.

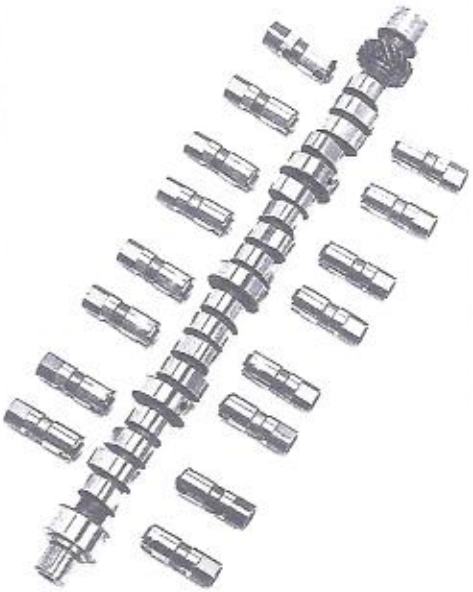
If you move up one-step, to a .484-inch lift cam, you can still use the same spring, but if you go to the next step, a .508-inch lift cam, then you should change the springs to *P5249847. This change is caused by the increased lift of the cam profile. These two springs were selected because they are single spring designs with a damper, which allow the use of an umbrella valve seal on the valve guide. The umbrella seal is the best street valve seal.

PISTON CLEARANCE

Next of concern in the cam selection process is piston clearance. Many cams are replaced with no other engine modifications. Bigger cams, or cams with more duration and more lift, require more valve-to-piston clearance. In high-performance production engines and some crate engines, the pistons are notched to provide added clearance. If you swap in a cam that is bigger than the original cam used for that specific package, then you will have less valve-to-piston clearance.

Low compression ratio engines (8-to-1) generally do not have a problem as long as they haven't been rebuilt or had the heads/block milled. The old rule-of-thumb for the muscle-car era HP engines was 284 degrees and .485-inch lift. A cam that was this large, or smaller, tended to fit (stock engines) while cams with larger specs should have the pistons notched. For example, on the B/RB big block wedge engines (383/400/440), the HP cam with 284 degrees duration and .484-inch lift tended to fit while the bigger .509-inch lift design would need bigger notches.

CENTERLINE: INTAKE & EXHAUST LOBE RELATIONSHIP



The various aspects of the cam's profile, lift, duration, etc., are controlled by the cam designer whether it is Mopar® Performance or an aftermarket manufacturer. In some cases, you can select or special order different centerlines that the cam is ground on. This centerline is the relationship between the intake lobe and the exhaust lobe. This relationship is usually given as the ground-on centerline with numbers like 110 or 114, or it can be given in the form of the cam's overlap.

The third aspect of cams is the installed centerline, and this is controlled completely by the engine builder/customer. Typically, the manufacturer will recommend an installed centerline like 108 degrees. To achieve this number, the customer should degree-in his cam and measure the actual centerline at installation. It takes a few extra minutes, but helps to avoid potential long-term problems.

To adjust the installed cam centerline, you will need offset cam bushings (*P3690936 for B/RB and 426 HEMI® Gen II engines) or offset cam keys (*P5249600 for Magnum® 5.2L/5.9L engines). The small block A-engine uses a one-size larger set of offset keys, which are available from aftermarket high-performance parts retailers.

UGLs

Typically, camshafts are actually manufactured from a semi-finished cam called an UnGround Lobe (UGL). UGLs are an internal part in the machining process and generally not sold. However, there are certain situations in racing that require their use. This usually relates to special engines that are unique from the mass-produced engines like A-engines and B/RB-engines.

RESTO CAMS

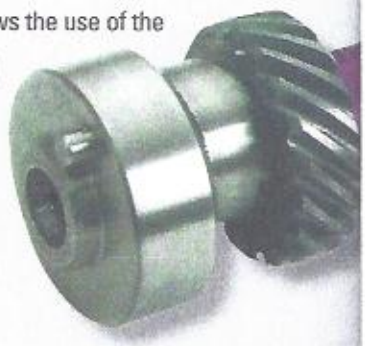
A related application to the very general street, dual-purpose usage is engines that are being used in "Resto." There are several shades to the resto-market, but I will assume that these engine owners would want to use the original production camshaft. Cams wear out with mileage and time so it is strongly recommended that the old, original camshaft and lifters be replaced.

A popular small block A-engine (340 & HP 360) resto cam (hydraulic) has 268/276 degrees duration, .429-inch/.444-inch lift and is ground on 114-degree centerline. Two popular big block resto cams — a 1-bolt and the 3-bolt *P4529270AC — both have durations of 268/284 and lifts of .450-inch/.458-inch. There are also two 426 HEMI Gen II resto cams — the newer hydraulic version (1970–71) and the earlier mechanical version (1966–69). Both have lifts of .484-inch/.475-inch.

OTHER CONSIDERATIONS

What if your choice is to use a mechanical camshaft on the street? To use a mechanical cam you must have adjustable rocker arms. Remember that you can use adjustable rockers with a hydraulic cam but you can't use stamped (non-adjustable) rockers with a mechanical cam.

A good street A-engine cam choice would be 284-degrees duration and .528-inch lift, which allows the use of the good valve spring *P5249847. A good B/RB street mechanical cam has 284-degrees duration and .528-inch lift (3-bolt design) — use valve spring *P5249848.



Not all applications want max power or have the rest of the engine hardware that would require power camshafts. The economy-power relationship hasn't been developed much yet, but if your dual-purpose approach leans toward economy, you might need a revised cam selection, although the resto cams are pretty good choices in general. With small displacement A-engines like the 273 and 318, you might want to choose a mild hydraulic cam with 248/256 degrees duration and .410-inch/.425-inch lift. ***Note:*** *typical stock cams for these engines had .390-inch or less lift and around 240 degrees duration.*

General dual-purpose street engines have many unique concerns. Hydraulic cams with wide centerlines, like 114-degrees, really help these engines idle, improve low-speed response and generally help around-town drivability. For example, a popular B/RB big block cam has 284 degrees and .484-inch lift and is ground on 114 centers making it a very good street cam, and a popular big brother with 292 duration/.509-inch lift is also quite streetable for this large of a profile. But, perhaps the biggest advantage is that these wide centerlines allow the customer to adjust their carburetor(s) much more easily — 4-, 6- or 8-barrels. High overlap (close centers) cams have always caused carburetor adjustment problems for many customers.

The new 5.7L HEMI® Gen III does not use the same cams as the earlier 426 HEMI Gen II. The 5.7L upgrade cam has .500-inch/.488-inch lift. The in-line 6-cylinder engines have the longest cams physically, but the 4.0L Jeep® engines have very mild cams — upgrade to a performance cam with .430-inch lift.

For more information on Mopar® high-performance camshafts, valve springs, tappets and more, call the Mopar Direct Connection Tech Line at **1-888-528-HEMI**.

*Not legal for sale on pollution-controlled vehicles or vehicle registered for highway use.

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