INSTALLING YOUR NEW CAMSHAFT

Congratulations! You have purchased a world-class replacement camshaft featuring premium materials and design. To ensure top performance and reliability, carefully follow all of these general installation instructions. Reference your vehicle engine manual for further instructions for your specific application.

Note!

Cam and lifters must be pre-lubed before installation.

Oil with high zinc (ZDDP) content is required for flat tappets/lifters and cams.

INSTALLATION STEPS

1. Access the engine's camshaft, lifters and timing chain, rotate the crankshaft to align the timing marks.

2. Remove the timing sprocket and chain, re-install the sprocket (without chain), and remove the camshaft.

3. Be sure to clean the new camshaft. A common shop solvent such as mineral spirits is appropriate. Next, place the cam sprocket on the new camshaft. Be sure to pre-lube the lobes and distributor gear. Bearing journals must be lubricated with an SAE-30 weight oil (do NOT use synthetic oil).

4. Carefully install cam into engine block.

5. Remove the cam sprocket, then install a new chain and finish the assembly. Double check engine manual to ensure proper alignment of timing marks. *Using your engine manual, make sure the timing marks are precisely aligned.*

6. Check the required torque levels for the engine and then tighten the sprocket bolts precisely to the desired torque. In cases where cam has only one bolt, apply thread-locker to the bolt's threads before torqueing. In cases where cam gears utilize three bolts, drill and wire the bolt heads or use a cam bolt locking plate.

7. If cam or replacement gears require a spacer plate, be sure to install a new plate. Do not re-use the old plate.

8. If cam retaining plates are used in the engine, use a straightedge to check gear alignment. Cam end-play should be .004" to .008".

9. Many Ford-Mercury V8 engines feature a retarded camshaft sprocket. In these cases, you must either use a non-retarded camshaft sprocket with the new camshaft or "degree in" the new camshaft. (Non-retarded sprockets feature precisely aligned dot and keyway slot.)

10. Do NOT re-use the original tappets/lifters with the camshaft. (Tappets/lifters should be coated with assembly lube prior to installation.)

11. Valve spring clearance at max lift MUST be at least .060" greater than the gross lift of the new camshaft. (This can be an issue on engines that will not be re-machined prior to assembly.) Inadequate valve spring clearance could cause coil bind, leading to valve-train failure.

12. Check for adequate valve-to-piston clearance. The use of modeling clay during assembly can identify contact issues. Minimum clearances are .080" (intake) and .100" (exhaust).

13. Check for interference of spring retainer to valve seal or valve guide. Also check retainer to rocker arm clearance throughout the lift cycle.

14. On any application (including SB Chevrolet) equipped with individual adjustable rocker arms, install the push rods and rocker arms and adjust the valves on a cylinder-by-cylinder basis. To avoid valve-to-piston

contact, do not tighten the adjusting nut before adjusting the valves. If the engine is equipped with shaft-mounted rocker arms that are adjustable, fully loosen all adjusters before assembly. Also, be certain the push rod is in the tappet and rocker arm seat when adjusting the valves.

15. To adjust the valves for use with a hydraulic lifter camshaft, manually rotate the engine (in normal direction) until the cylinder's exhaust lifter begins to rise and then adjust the intake valve to zero lash with zero preload. Now take an additional one-half to one full turn. Next, rotate the engine until the intake lifter has fully risen and is almost completely down. At this point, set the exhaust valve to zero lash, then take one-half to one full turn more. Use this procedure for each cylinder.

16. If the engine is not equipped with adjustable rocker arms, set lifter preload to between .020" and .060", then use the same adjustment sequence to make sure the lifter is on the "heel" of the cam when measuring preload.

17. Some engines, such as the big-block-Chevy, have different length pushrods for intake and exhaust. Most engines have the same length pushrods through out. Make sure pushrod length is consistent through the valve train. If not, check to see if valve stem heights are incorrectly matched. When checking lifter preload, make sure the lifter has fully bled down and that the corresponding valve is not open. If these procedures are followed correctly, it should not be necessary to make additional adjustments over the life of the new camshaft.

    On mechanical cams, it is appropriate to use the same adjustment procedures, but use the clearance specifications printed on the cam card.

18. Once all the parts and gasket/sealing surfaces have been cleaned, install replacement gaskets and reassemble the engine.

19. Next, rotate the crankshaft until cylinder #1's piston begins the compression stroke. At this point, align the damper timing mark with the factory-specified initial timing setting. (Both valves will be closed.) Then, install the distributor with the rotor pointing to the #1 cylinder spark plug in the cap.

20. Fill the engine with quality SE, SF, SG or racing oil and add a high-quality break-in concentrate. Fill the new oil filter with oil. Use straight viscosity mineral oil during break-in, multi grade maybe introduced after break-in period. Do NOT use synthetic oil with your new camshaft.

21. Break-in: Make sure the engine runs at 1500-2000 rpm during the first 30 minutes of operation. *Do not run the engine below 1500 rpm during the first 30 minutes of operation*. Vary RPM above the minimum 1500 level to enhance oil splash. Change the oil and filter after this initial period. The engine may now be started and stopped to adjust ignition timing, valve lash, and fuel settings. (Make sure engine is warm when adjusting valves.) After the next hour or 100 miles of operation, change the oil and filter again.

OIL FOR CAMSHAFTS & LIFTERS

During the break-in period and for the life of the engine, all cams & lifters need oil with ZDDP (Zinc Dialkyl-Dithio-Phosphate). Traditional flat tappets and cams (either hydraulic or mechanical) were originally designed to be lubricated with higher levels of ZDDP and Moly. These minerals coat and protect the high-pressure surface area of the cam lobe and lifter base. The same minerals were later found to coat the inside of modern emission systems, reducing their functions. Modern roller-lifters and cams have less pressure resistance, and require lower levels of ZDDP for the same protection.

As new car manufacturers switched from flat tappets/lifters to roller lifters, ZDDP parts-per-million (PPM) were reduced in each new API oil rating. Flat tappet cams and lifters will be best protected by oil with and API rating of SJ or prior (SG, SF, etc). Off-road / Racing oils may have higher ZDDP content than on-road oils. Some oil manufacturers offer higher content ZDDP oil by special order. Today's on-road oils such as SL, SM, SN, SN-Plus, etc., will all need to be blended with a ZDDP concentrate supplement to protect flat tappets/lifters and camshafts.

WHAT'S YOUR HYDRAULIC LIFTER PRELOAD?

When installing a hydraulic camshaft, it is critical to check lifter "preload," or the distance the push rod is extended into the lifter and depresses the push rod seat from its retaining ring. Insufficient preload can cause undue valve-train noise; excessive preload can cause a variety of engine performance issues.

Using a dial indicator is the best way to check preload. Lacking a dial indicator, use the following steps:

1. Re-torque all bolts per engine repair manual.

2. Wait a few minutes to allow all oil to bleed from the lifter.

3. Lay a marking tool such as a metal scribe across the valve cover gasket surface and create two marks and scribe a line on the push rod.

4. Unbolt the rocker assembly and loosen fasteners to allow the push rod to stand free in the lifter's seat. (The push rod seat will be lodged against the snap ring at the top of the lifter.)

5. Scribe another mark – the second – on the pushrod. The lifter preload is the distance between the two marks. Preload should be between .020" and .060".

6. To correct excessive load, "shim up" a bridge mount or pedestal mount assembly. To correct too little preload, first measure the amount of free play between the rocker arm and push rod, then add .030" to the total. Check your measurements several times.

7. Replace the push rods with units that are longer than stock by the amount of your measurement from Step 6.

8. Check two push rods (one intake, one exhaust) per head.

9. When valve stem heights are either uneven or different from factory specifications, lifter preload must be checked on each valve. (Measure from the spring seat to the top of the valve to compare valve dimensions with the factory specifications.)

10. In cases when a machinist is performing the work, request that he or she double check valve stem height.

11. Engines with bottleneck type studs include special adjusting nuts to simplify setting lifter preload. These nuts are tubular in construction and feature allen-type head set screws. Tighten the nut until you reach zero lash (no preload and no lash) and then tighten one-half to one full turn more. While holding the nut with an end wrench, tighten the allen head set screw against the top of the stud. Perform the same process for all valves.

12. To reduce preload on engines equipped with pedestal or shoulder bolt-mounted rocker arms, use a shim under the pedestal or shoulder. To increase preload, longer-than-stock push rods must be used. (See steps 6 and 7.)

13. To achieve correct lifter preload on engines with individually mounted rocker arms, tighten the adjusting nut or bolt to zero lash. Next, torque the nut or bolt by one-half to one full turn of torque wrench rotation. If this process does not provide correct preload (.020" to .060"), you will need to use the appropriate shim kit or longer-than-stock push rods as described in steps 6 and 7.

CAMSHAFT TROUBLESHOOTING GUIDE

Properly adjust valve lash
Consult the engine repair manual to set appropriate valve lash before firing up the engine.

Check for rocker arm interference
Performance camshafts usually increase the amount of maximum valve lift as compared to a stock camshaft. If the engine has stud-mounted rocker arms, check the slot that allows the rocker arm to pivot at maximum lift. You must have additional (.060") travel in the slot when the valve is at maximum lift. (The rocker arm contacts only the valve tip, not the spring or spring retainer.)

Check for valve-to-piston clearance
A lack of valve-to-piston clearance will end up in broken or bent valves. Checking clearance is particularly important in engines with domed pistons or when the new camshaft has more duration and/or higher maximum lift than the previous cam. The easiest way to check engine clearance is to use modeling clay. Place the clay on top of the valve area of the piston, bolt the head into place and torque to specs. (Be sure to install the head gasket.) Adjust the valves and then rotate the engine several times by hand. Then remove the head, carefully peel off the clay and measure it with a micrometer. Allow a minimum clearance of .080" for intake and .100" for exhaust.

Look for bent push rods
Any bent push rods mean there is mechanical interference in the valve-train. Common problem areas are: rocker arm to stud; binding of the valve spring coil; retainer and valve seal interference; and retainer and valve guide interference. High-RPM operation also might uncover valve-to-piston clearance issues, check for a bent valve or leaking cylinder as well as possible damage to a piston.

"Degree in" the camshaft before advancing or retarding cam timing
Retarded cam timing is commonly due to factory retarded timing gears. An indication of this problem is if the engine does not seem to have enough low-end power after a cam change. Before making any timing changes, always "degree in" the cam.

Never re-install old lifters with a new cam
Re-using the same tappets/lifters with a new camshaft is simply an invitation to significant performance and reliability problems.

Properly lube the cam
New cams can be destroyed in a matter of minutes unless they are properly lubricated prior to installation. Follow the instructions for pre-lubing the cam and lifters before firing up the engine.

Cam break-in – the right way
Carefully follow the manufacturer's instructions for breaking in a new cam and lifters. Always use new oil and a new oil filter. And buy quality oil and filters to ensure long, trouble-free life. Above all, change the oil and filter on a frequent basis.

Breaking rocker arm push rod seats
It is always best to install new stock-type steel rocker arms or aluminum rockers for use with a new camshaft. When a new cam with higher lift is installed in an engine, it can cause concentrated load on the push rod seats of older rocker arms. This can result in breaking through of the thinner metal of the seat area.

Do not use synthetic oil during break-in
It is NEVER advisable to use synthetic oil during the break-in of regular flat-faced hydraulic or mechanical (non-roller) lifter style camshafts. Use a quality grade of naturally formulated, non-synthetic motor oil during this period.