REASONS AND CAUSES FOR CAM FAILURE

Cam failure is rarely caused by the cam itself. The only things we can control during manufacture pertaining to cam lobe wear, are lobe taper lobe hardness and surface finish. Of all the damaged cams we have checked over the years, more than 99.99 percent have been manufactured correctly. Some people have the misconception that it is common for a cast iron flat tappet cam to occasionally have a soft lobe. We have yet to see a cast iron flat tappet cam that had a soft lobe.

When the cast core is made at the casting foundry, all the lobes are flame hardened. That process hardens all the lobes to a depth below the barrel of the core. That depth of hardness allows the finish cam grinder to finish grind the cam lobes with a Rockwell hardness above 50Rc. The generally accepted hardness on a finished cast cam should be between 48Rc to 58Rc.

All of the finished cams that we have checked are always above 50Rc hardness on the lobes. Many outside factors, or a combination of factors, can cause cam failures. We will list some of the factors we have determined that may cause camshaft failure.

1. Lobe wear
A) Incorrect break-in lubricant.
Use only the **Moly Paste, Part Number 99002-1** that is included with the cam. This Moly Paste must be applied to every cam lobe surface, and to the bottom of every lifter face of all flat tappet cams. Roller tappet cams only require engine oil to be applied to the lifters and cam. Also, apply the Moly Paste to the distributor gears on the cam and distributor for all camshafts. For extra protection, an anti-wear additive should be added, such as **Crane Super Lube, Part Number 99003-1.**

NOTE: Do not use synthetic oil during the break-in period. It is not recommended to use any type of oil restrictors to the lifter galley, or use windage trays, baffles,or plug any oil return holes in the valley. Oil has a two-fold purpose, not only to lubricate, but to draw the heat away from whatever it comes in contact with. The cam needs oil splash from the crankcase, and oil run-back from the top of the engine to help draw the heat away. Without this oil flow, all the heat generated at the cam is transferred to the lifter, which can contribute to it's early demise.

B) Correct break-in procedure.
After the correct break-in lubricant is applied to the cam and lifters, fill the crankcase with fresh non-synthetic oil. Prime the oil system with a priming tool and an electric drill so that all oil passages and the oil filter are full of oil. Pre-set the ignition timing and prime the fuel system. Fill the cooling system. Start the engine. The engine should start quickly and run between 1500 and 3000 rpm.

If the engine will not start, don't continue to crank for long periods, as that is very detrimental to the life of the cam. Check for the cause and correct. The engine should quickly start and be run between 1500 to 3000 rpm. Vary the rpm up and down in this rpm range during the first 15 to 20 minutes, (do not run the engine at a steady rpm). During this break-in time, verify that the pushrods are rotating, as this will show that the lifters are also rotating. If the lifters don't rotate, the cam lobe and lifter will fail. Sometimes you may need to help spin the pushrod to start the rotation process during this break-in procedure.

> **(a) Note:** Lifter rotation is created by a taper ground on the cam lobe and the convex shape of the face of the flat tappet lifter. Also in some cases, the lobe is slightly offset from the center of the lifter bore in the block. If the linear spacing of the lifter bores in the block is not to the correct factory specifications, or the angle of the lifter bore is not 90 degrees to the centerline of the cam, the lifter may not rotate.
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> Even if the engine you're rebuilding had 100,000 miles on it and the cam you removed had no badly worn lobes, this still doesn't mean that your block is made correctly. It just means that the break in procedure caused

everything to work correctly. Be careful to watch the pushrods during break in to verify lifter rotation. Don't assume everything will work correctly the second time.

(b) Note: Always use new lifters on a new flat tappet cam. If you are removing a good used flat tappet cam and lifters and are planning to use them again in the same (or another) engine, you must keep the lifters in order as to what lobe of the cam they were on. The lifter breaks-in to the specific lobe it is mated with and it can't be changed. If the used lifters get mixed up, you should discard them and install a new set of lifters and break the cam in again as you would on a new cam and lifters. You can use new lifters on a good used cam, but never try to use used lifters on a new cam.

(c) Note: Roller tappet cams don't require any break-in. You can use roller lifters over again on a new cam if they are in good condition. There will be, of course, no lifter or pushrod rotation with the use of a roller tappet cam.

C) Spring pressure

Normal recommended spring seat pressure for most mild street-type flat tappet cams is between 85 to 105 lbs. More radical street and race applications may use valve spring seat pressure between 105 to 130 lbs. For street hydraulic roller cams, seat pressure should range from 105 to 140 lb. Spring seat pressure for mechanical street roller cams should not exceed 150 lb. Race roller cams with high lift and spring pressure are not recommended for street use, because of a lack of oil splash onto the cam at low speed running to help cool the cam and lubricate the lifters. This high spring pressure causes the heat created at the cam to be transferred to the roller wheel, resulting in its early failure. Any springs that may be used must be assembled to the manufacturer's recommended height. Never install springs without verifying the correct assembled height and pressures.

NOTE: Increased spring pressure from a spring change and/or increased valve lift can hinder lifter rotation during cam break-in. We have found that decreasing spring pressure during the break-in period will be a great help. This can be accomplished by using a shorter ratio rocker arm to lower the valve lift; and/ or removing the inner spring, during the cam break-in time, if dual springs are being used.

D) Mechanical interference.

There are many factors that can cause mechanical interference.

(1) Spring coil bind: This is when all of the coils of the spring (outside, inside or flat damper) contact each other before the full lift of the valve. We recommend that the spring you are using be capable of traveling at least .060" more than the valve lift of the cam from its assembled height.

(2) Retainer to seal/ valve guide boss interference. You need at least .060" clearance between the bottom of the retainer and the seal or the top of the valve guide when the valve is at full lift.

(3) Valve to piston interference: this occurs when a change in cam specs. (i.e.; lift, duration or centerline) is enough to cause this mechanical interference. Also: increased valve size, surfacing the block and/or cylinder head may cause this problem. If you have any doubt, piston to valve clearance should be checked. Minimum recommended clearance: .080" intake and .100" exhaust.

(4) Rocker arm slot to stud interference: As you increase valve lift, the rocker arm swings farther on its axis. Therefore the slot in the bottom of the rocker arm may run out of travel, and the end of the slot will contact the stud and stop the movement of the rocker arm. The slot in the rocker arm must be able to travel at least .060" more than the full lift of the valve. Some engine families, like small block Chevrolet, have stamped steel rocker arms available in long and extra long slot versions for this purpose.

2) Distributor gear wear.

The main cause for distributor gear wear is the use of high volume or high-pressure oil pumps. We don't recommend the use of these types of oil pumps. If you do run these types of oil pumps, you can expect short life of the cam and distributor gears, especially for low speed running, in street type applications. If you must run these types of oil pumps, you can increase the life of the gears by adding more oil flow over the gear area to help cool off the point of contact.

NOTE: distributors that have end play adjustment (up and down movement of distributor shaft and gear), Maintain a maximum of .010" end play, to help prevent premature wear.

3) Camshaft end play.
Some engines have a thrust plate to control the forward and backward movement of the cam. The recommended end play on these types of engines is between .003" to .008". Many factors may cause this end play to be changed. When installing a new cam, timing gears, or thrust plates, be sure to verify end play after the cam bolts are torqued to factory specs. If the end play is excessive, it will cause the cam to move back in the block, causing the side of the lobe to contact an adjacent lifter.

4) Broken dowel pins or keys.
The dowel pin or Woodruff key does not drive the cam; the torque of the timing gear bolt, or bolts, against the front of the cam drives the cam. Some reasons for the dowel pin or key failing are: Bolts not being torqued to correct specs; Incorrect bolts of a lower grade being used; Stretching and losing torque; Not using the correct hardened washer that may distort and cause torque of the bolt to change; LocTite not being used; Or some interference with the cam and lifters or connecting rods causing the cam to stop rotation.

5) Broken cam
A broken cam is usually caused by the cam being hit by a connecting rod, or other rotating parts of the engine coming loose and hitting the cam. When this happens, the cam will usually break in more than two-pieces. Sometimes the cam will break in two pieces after a short time of use because of a crack or fracture in the cam due to rough handling during shipping, or some time before installation. If a cam becomes cracked or fractured due to rough handling, it will generally not be straight.

Most people will not have any means of checking cam straightness. As a general rule, if you can install the cam in the engine and install the timing gear, the cam should turn freely with just your finger pressure. There should not be any drag or resistance in turning the cam. This free turning of the cam is assuming that if new cam bearings were installed, they were the correct parts and they were installed correctly.

NOTE: When removing a used cam that may be worn, you may have difficulty turning or removing it. This may not mean that the cam is cracked or fractured. The heat generated at the cam during the failure of the cam lobe, and/or lifter, will distort the cam and cause it not to be straight any more