Five Ways Crankshaft Noses Break And How to Prevent it Happening

There have been numerous questions and issues raised recently about the nose of the crank and what can cause it to break. In many cases, although the crankshaft gets the blame for such failures, it's usually the parts being used in conjunction with the crank and the additional machining done to those parts that are mostly responsible for crank breakage.

Figure 1 *When the nose of the crank is able to flex, a fatigue crack starts and – SNAP! The crank breaks.*

1. Improperly Machined Crank Gears

• Chamfer machined at wrong angle or too small an angle.

• Belt drive gears. The seal sleeve bottoms to the face of the main before the inner face of the gear bottoms against the step in the nose of the crank. This prevents the crank gear from bottoming against the step on the nose of the crank, leaving a gap between the gear and the step, which allows the crank to flex. A fatigue crack starts – SNAP! The crank breaks. See **Figure 1**.

2. Dampers with Moving Inertia Weights (fluid, balls, springs, inertia rings with rubber O-Rings, etc.).

Can you balance a wheel on your race car if the tires are flat? How can your rotating assembly be balanced if, to quote one manufacturer: "These units (dampers) should not be on the crank for balancing as the inertia weight may not be centered until the engine starts."

Centrifugal force will always take the inertial weight off-center no matter what rpm. Your assembly is never balanced. Metal transferred on nose outside diameter and damper internal diameter will fatigue and start to crack, resulting in a broken crank.

3. External Balance vs. RPM

Rotating weight is multiplied as rpm increases. Engines have heavier or lighter balance weights and larger or smaller noses. RPM above 5,500 is more risky on a Small Block Chevy than a Big Block Chevy. However, as rpms go up, the weight will try to leave the crank due to centrifugal force. Do not be surprised if at some point fatigue sets in and the nose comes off.

4. Drives Extending Beyond the Normal Distance on the Nose

Multi-stage oil pumps, blowers and other components have belt drives that require torque taking off at 90 degrees to the center line of the crank. More torque is necessary for driving these things. The further away they are from main bearing support leads to a multiple of leverage wiggling the nose. Fatigue sets in, the nose breaks and the blower stops.

The Small Block Chevy has the smallest diameter nose and is the weakest of all. Be aware that blowers take substantially more 90 degree torque than dry sump pumps, and are, therefore, more likely to break noses. While not recommended for Small Block Chevy, if a blower is being used, use a crank with a Big Block nose.

5. Improper Balancing Technique

The counterweights on a crankshaft are designed to work all together as a system within a certain bob weight range. To correct the balance on a crank where the counterweights are too heavy the following should be followed:

Internal Balance: If more than 2 holes are required in each end, the outer diameter of all the counterweights should be turned in a lathe to correct the out-of-balance condition in all the counterweights. If you try to drill more holes, you will create a secondary wave which will lead to crank flex and eventually a fatigue crank. See **Figure 2**.

External Balance: The crank is spun with the external balance and flywheel. If it is determined that the assembly is too heavy where the weight is on the damper and flywheel, do not make the correction on the end counterweights of the crank. The out-of-balance condition is in the damper and flywheel, which is where it should be corrected. It is very simple to alter the bolt-on weight of the damper and drill the balance weight on the flywheel. If these components need to be replaced, simply bolt on the proper weight to the damper and match balance the flywheel which has to be balanced anyway.

If you attempt corrections in the end counterweights, you will create a wave in the crank which will wiggle the nose of the crank, eventually starting a fatigue crack which will snap the crank.

Tech bulletin courtesy of Scat.

Camshaft Failures Are Rarely the Fault of the Camshaft Itself

The camshaft itself is rarely to blame for cam failure. When the cam core is made at the casting foundry, all the lobes are flame hardened to a depth below the barrel of the core, allowing the cam grinder to finish grind the lobes to an acceptable shape while maintaining the correct hardness.

Here's a list of common mistakes we have determined to cause camshaft failure:

1. Lobe Wear – Use only the manufacturer recommended lubricant, which is generally included with the cam. This lubricant 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 lubricant to the distributor drive gears on the cam and distributor.

2. Incorrect Break-In Procedure – After the

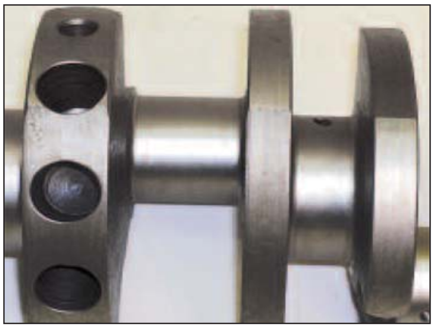

Figure 2 *Counterweights should be turned in a lathe to correct an out-of-balance condition.*

correct break-in lubricant (see **Figure 3**) 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. Preset the ignition timing and prime the fuel system. Fill the cooling system. Start the engine. The engine should start quickly and run between 1,500 and 3,000 rpm.

If the engine will not start, don't continue to crank for long periods as this can shorten the life of the cam. Check for the cause of the problem and correct it.

Vary the rpm up and down in this rpm range for 20 minutes. During break-in, 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.

3. Always Use New Lifters With A 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 the order they were removed from the cam they were on. Lifters "mate" to their specific lobes and can't be changed. If the used lifters get mixed up, discard them, install a new set of lifters, and break in the cam in again. You can use new lifters on a good used cam, but never use used lifters on a new cam.

4. Incorrect Valve Spring Pressure – Recommended valve spring seat pressure for most street-type flat tappet cams is between 85-105 lbs. More radical street and race applications may use valve spring seat pressure between 105-130 lbs. For street hydraulic roller cams, seat pressure should range from 105-140 lbs. Mechanical street roller cams should not exceed 150 lbs.

Race roller cams with high valve lift and spring pressure are not recommended for street use, because of a lack of oil splash onto the cam at low speed running. Springs 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. Decreasing spring pressure during break-in can be accomplished by using a shorter ratio rocker arm to lower the valve lift and/or removing the inner spring if dual springs are being used.

5. Mechanical Interference

A. Spring coil bind – This is when all of the coils of the spring contact each other before the valve fully lifts. Valve springs should be capable of traveling at least .060″

Figure 3 *Use only the manufacturer-recommended lubricant, which is generally included with the cam.*

more than the valve lift of the cam from its assembled height.

B. Retainer to seal/valve guide boss interference – At least .060″ clearance is required between the bottom of the retainer and the seal or the top of the valve guide when the valve is at full lift.

C. Valve to piston interference – This occurs when a change in cam specs (lift, duration, or centerline) is enough to cause the valve and piston to contact. Also, increased valve size or surfacing the block and/or cylinder head may cause this problem. Minimum recommended clearances are .080″ intake and .100″ exhaust.

D. 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 movement. The slot in the rocker arm must be able to travel at least .060″ more than the full lift of the valve.

6. Distributor Gear Wear – The main cause for distributor gear wear is the use of high volume or high pressure oil pumps. If these types of oil pumps are used, reduced cam and distributor gear life will result. However, you can increase the gear life by adding more oil flow over the gear area to help cool off the point of contact.

7. Camshaft End Play – Some engines use a thrust plate to control the forward and backward movement of the camshaft in the block. The recommended amount of end play on these types of engines is between .003″ to .008″. Many factors can cause end play to change. 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.

8. Broken Dowel Pins Or Keys – The dowel pin or Woodruff key does not drive the cam; the torque of the timing gear bolts against the front of the cam does. Reasons for the dowel pin or key failing include: Bolts not being torqued to correct specs, incorrect bolts of a lower grade stretching and losing torque, not using the correct hardened washer which may distort and cause torque of the bolt to change, thread locking compound not being used, or some interference with the cam, lifters, or connecting rods causing the cam to stop rotation.

9. Broken Cam – A broken camshaft is usually caused by a connecting rod or other rotating part coming loose and striking it. Sometimes the cam will break after a short time of use because of a crack or fracture in the cam due to rough handling during shipping or improper handling prior to installation.

Tech bulletin courtesy of Summit Racing Equipment **TSG**