

THE EXTRA MILE

Engine Building and Power Techniques

BY SCOTT SEHR



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CHECK YOUR ENGINE'S PULSE

Correct Ratios = Correct Lift



When discussing an engine's camshaft, we often speak of lift, duration, overlap, lobe separation, and lobe centerlines. Lift seems to be the first thing mentioned when talking about camshafts. Lift is the full lift of the valve in thousands of an inch. Most people don't realize that cam lift and valve lift are not the same. Lift is advertised by taking the cam lift times the rocker ratio so valve lift is also affected by rockerarm ratios and can be modified by changing ratios. When cam specs say .550 lift, that may not be what you really get. Most rocker arm ratios are less than advertised, so if your cam has an advertised lift of .550", the actual valve lift may only be .525". If your target maximum lift is .550" and you're getting .525" the engine will not meet its potential.

Cam duration is a measurement that can be taken at several different lifter rise points off the base circle in thousands of an inch. Cam duration is the number of crankshaft degrees that the tappet is off the cam's base circle at the given amount from opening to closing. The most common duration measurement is at .050" tappet rise but can also be given at .006", .020", and .200". Comparing duration numbers from all the various tappet lifts, we can determine the aggressiveness of the cam lobes. The closer the numbers are together, the more aggressive the cam profile. The more aggressive lobes typically have better response and power but also require heavier springs and better valve train components to maintain proper valve train stability.

Overlap is the period in crankshaft degrees in which both valves are open at the same time. This allows the intake and exhaust systems to affect one another and can greatly affect the engine's performance. This depends on the efficiency of intake and exhaust systems and the shape

of the combustion chamber. It can get technical but heads that don't flow very well can benefit from more overlap. As the piston is pushing out the spent combustion gasses, the velocity of the gas going out of the exhaust port can actually help pull in the new intake gas charge to a point. More overlap can also bleed off excess dynamic compression pressure as well as help aid in the use of certain octane fuels. Lobe separation is measured in crankshaft degrees between the maximum lift of the intake and exhaust lobes/valves. This is ground into the camshaft and cannot be changed. Using this with the lobe duration gives the cam overlap. A narrower lobe separation gives the engine more overlap and can give the engine a more choppy/aggressive sound. Stock cams have a wider lobe separation to smooth out the idle and raise the effective dynamic compression ratio. Engines that are run at high rpm, have high flowing heads, forced induction, or use NOS, can also benefit from a wider lobe separation.

Lobe centerline is the number of crankshaft degrees from maximum lift to TDC. Every cam has a power band built into it. A cam's power band is determined by lift, duration, overlap and lobe separation. This centerline angle can be changed by degreeding in the camshaft. If a cam has a power band of 2000-5500 RPM advancing the camshaft intake centerline can move the power band to 1800-5300 RPM or it could be raised to 2200-5700 by retarding the intake centerline. The more this changes in crankshaft degrees, the more the power band changes to a point.

Camshafts can be complicated so when it comes time to choose the camshaft for your engine build, seek the help of a professional engine builder. At Sehr Performance our job is to help you get the maximum performance out of your engine.

