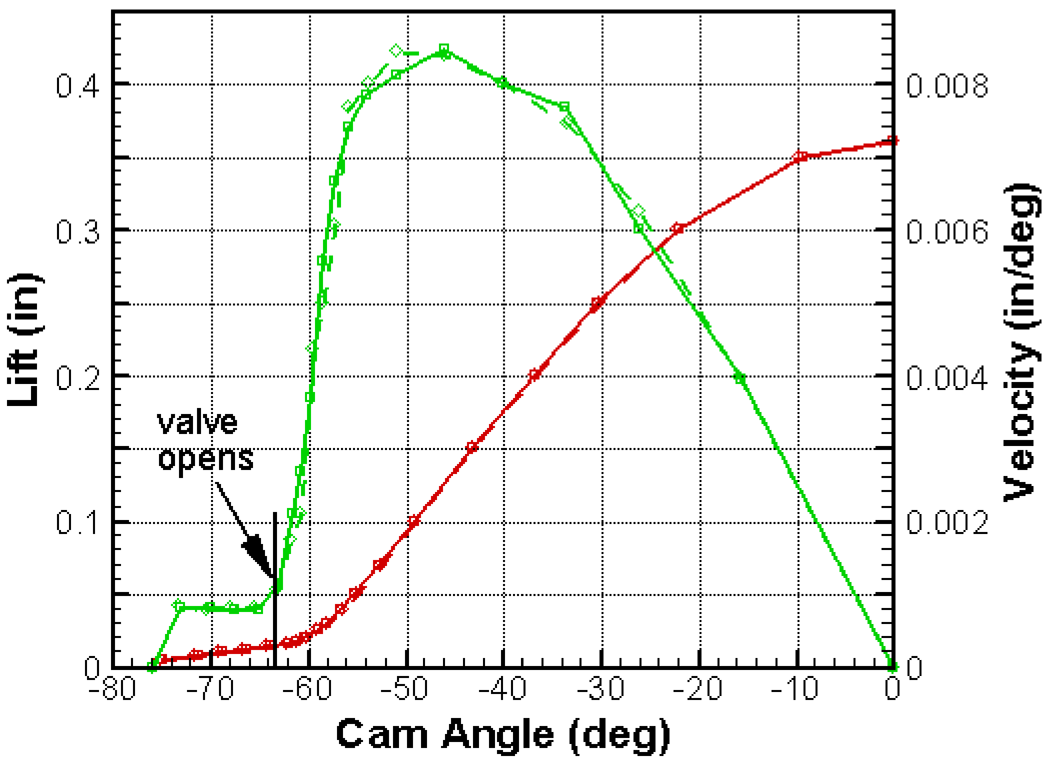
How to Determine Valve Lash

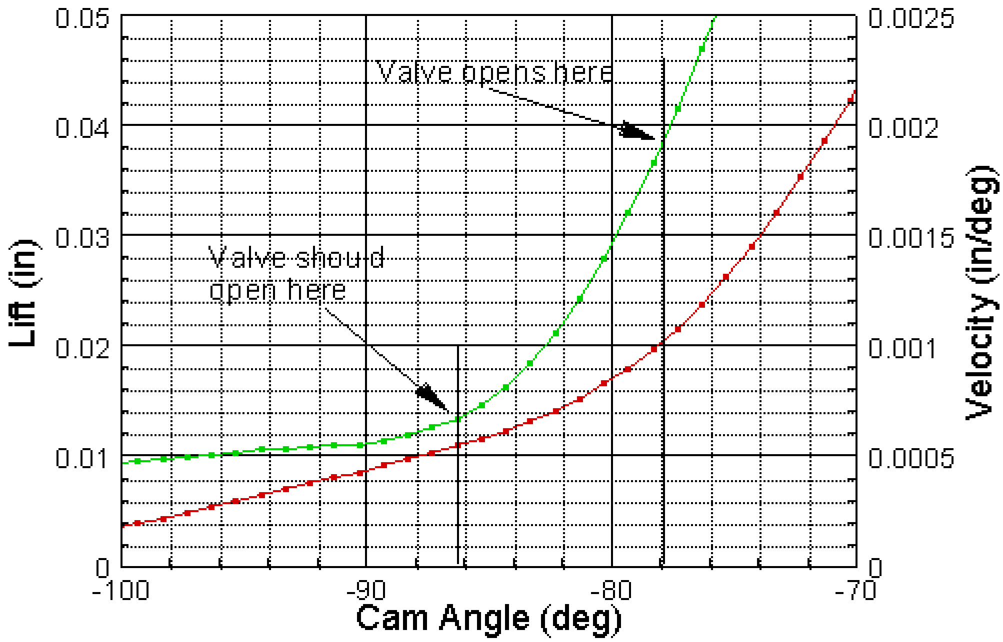
For solid lifters, you need to know the valve lash. Since the purpose of a ramp is to avoid a high velocity collision, the valve should open and close at the end of the ramp. The cam in the graph at right has a typical constant velocity ramp, and the desired valve opening point is indicated. This point occurs at a lift of 0.0147". As the cam rotates, it will first reach a lift that removes all slack within the valve train. Due to clearances around the bearings and flexibility within the valve train, there will then be a brief lift period before the valve opens. This is called valve train *squish*. For a stiff direct attack system (OHC, flathead), the squish is perhaps 0.002 inches, while for a more flexible OHV system with higher spring pressures it might be as high as 0.004". To determine the valve lash, subtract the squish from the desired valve opening lift. The cam in the graph is for a flathead, using squish of 0.002" the valve lash should be 0.0127" or 0.013". The exhaust could be set a couple thousandths larger to allow for thermal expansion. The Ford Model A/B and early V8 cams (<1949) all had ramps that ended at 0.015" lift and Ford recommended a valve lash of 0.012" on the intake and 0.014" on the exhaust.



Determining valve lash for an OHV cam is more complicated due to the rocker ratio. For example, if the ramp of a cam ends (i.e. the velocity curve turns up) at a lift of 0.010", using 0.003" for the squish and the rocker ratio of 1.5:1, the valve lash should be (0.010" - 0.003") x 1.5 = 0.0105. Depending on the thermal expansion characteristics of the cam materials (aluminum, steel), it may be necessary to use a somewhat larger valve lash. The lash should be checked **both <u>hot</u> and <u>cold</u>** to determine the effect of thermal expansion.

Not all cams have a constant velocity ramp like these two examples. Some ramps have an increasing velocity (positive acceleration), but there is a point at which the velocity starts to increase rapidly. This should occur when the velocity is not excessively large (usually < 0.0010 in/deg). The point of rapid increase in the velocity is the point where the valve should open.

Another Example



When valve lash is significantly beyond the ramp, this leads to the valve opening and closing on the flank of the cam with a high velocity impact. The high velocity impact of the valve hitting the seat is not good for valve seats, and high spring pressure is needed to avoid valve bounce after it hits the seat.

The graph above shows the lift and velocity in the opening ramp area for one of the three cams which opened on the flank. The cam closing is a mirror image. For this cam the cam card recommended a valve clearance of 0.026 inches, so the valve will open at approximately:

$$(0.026")/(1.5) + 0.003" = 0.0203"$$

The graph shows a gradually increasing ramp velocity of about 0.0005 in/deg and then a rapidly increasing velocity on the flank. The point where the valve will open is indicated on the graph. It corresponds to a velocity of 0.0019" and an acceleration which is 70% of the maximum acceleration. This must be hard on valve seats. If the lash were correctly specified, the valve would open where indicated with a lift of about 0.011" and a velocity of about 0.0007". The valve lash should be about 0.012" not 0.026". Using the correct lash increases the seat-to-seat duration by 32 degrees, with only a small change in the 0.050" duration. This increased seat-to-seat duration would be detrimental to performance. Always take the time to degree your cam.