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EVO: Engine Mechanicals - Sub-02E

Cam Grind Comparisons

TDC Lift and Overlap

At piston overlap TDC (exhaust stroke), the cams are positioned such that both valves are slightly open. The operative cam spec is the “TDC Lift” for both the intake and exhaust valve. That's how much the valves are open at top dead center between the exhaust and intake strokes, which is the overlap period (the exhaust cycle is ending as the intake cycle begins, and the two cycles overlap each other). Overlap allows the exhaust to affect intake flow. A poorly working exhaust really should have as little overlap as possible. This is why the D cams have so little. But an exhaust that's pulling hard during overlap can utilize a larger overlap window to pull on the intake and help cylinder fill. [1)]

“Bolt-in” for 1200 heads and “bolt-in” for 883 heads are two different things. [2)]
883's have longer valves than 1200's have. They do that so the valve heads will be closer together, to fit within the 883's 3 inch diameter chamber. The 883 chamber is shallower to match. That means the valves start out closer to the pistons to begin with, as compared to 1200 heads.

The critical period is during overlap, when the piston passes through TDC with both valves open. That's when you can get into trouble with piston to valve clearance. P-V clearance has nothing to do with max lift as many people mistakenly assume, because max lift always occurs with the piston well down the bore. It's the lift during overlap that you need to be concerned about.

Hammer Performance tells customers you're taking a chance when you run a TDC lift of over about .200“ on either valve, when using stock 883 heads. I have seen many times when the N4's have caused contact when used with stock 883 heads. Generally it's slight, only enough to mark the valve pockets, not enough to bend the valves, but enough to make some noise. Not all do it though. It's roughly 50-50. Depends a lot on the pistons used. But if you're that close to making contact, a little bit of float is going to get you in trouble in a hurry. The piston chases the exhaust valve closed, so that's where you get contact during float. The intake valve chases the piston down, so float doesn't put you at risk on the intake side.

If you want a set of cams that gives an N4 type power band, but are totally safe for 883 heads, look at the Feuling 505/515 grind. Compare the specs and you'll see that they're a lower overlap version of the N4's, with correspondingly lower TDC lifts. I suspect they designed them that way specifically to make them safe with 883 heads.

N4's: intake timing 30/46, exhaust timing 52/24, TDC lifts .216/.189
505/515's: intake timing 11/48, exhaust timing 53/15, TDC lifts .137/.150

The timing events that are significantly different are the intake open (30 degrees vs 11 degrees, BTDC) and exhaust close (24 degrees vs 15 degrees, ATDC). Those are the two timing events that define the overlap, because during overlap, the intake is opening and the exhaust is closing. The overlap is just the intake open point plus the exhaust close point. That's the number of crankshaft rotation degrees that both valves are hanging open at the same time (“open” being defined as above .053” of valve lift).

On the N4's, that's 30+24 = 54 degrees of overlap.
On the 505/515's, that's 11+15 = 26 degrees of overlap.

Since the 505/515's open the intake valve 19 degrees later than the N4's, the intake valve is only open .137 as the piston gets to TDC, as compared to .216 for the N4's. Since the 505/515's close the exhaust valve 9 degrees sooner than the N4's, the exhaust valve is only open .150 as the piston passes through TDC, as compared to .189 for the N4's.

The main driver of the rpm range of the cams is the intake close point. At 48 degrees for the 505/515's, that's really close to the 46 degrees of the N4's. So the rpm range will be similar. The downside to reducing overlap, however, is you lose exhaust augmentation of the intake flow. The N4's will be more sensitive to the pipe, which is a good thing if you've got a good pipe.
However, having more overlap in the cams gives more control of the powerband to the exhaust pipe. Exhaust augmented intake flow is an extremely effective way to fill the cylinder. I suggest running some overlap and getting a pipe that utilizes that overlap to give you the powerband you want. When you have overlap in the cams, the pipe has a profound effect on the motor, use it to your advantage. Really, the only time I would ever want to limit the overlap in the cams is to mitigate the negative effects of a lousy pipe. But if you've got a good pipe, overlap is your friend. [3)]

.226/.212 are not overly high TDC lifts and at stock valve sizes (1.810/1.575), it's not going to cause any valve to valve clearance concerns. Just as a point of reference, SE .536's are similar at .212/.236 and these are routinely run with larger than stock valves (1.850/1.615) without sinking and we still get .045-.060 of valve to valve clearance. [4)]

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[1)], [3)]
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https://www.xlforum.net/forum/sportster-motorcycle-forum/sportster-motorcycle-motor-engine/sportster-motorcycle-motor-top-end/55471-questions#post1151157
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