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APT CAMS

Designed & Ground In House

Cam Stuff

Nowhere in the twists and turns of working on, or rebuilding your cars engine is there more of a smoke and mirrors game played than the subject of camshafts.
Just as you think you are getting a grip on the details along comes another perhaps contradictory dissertation on the subject.

There is absolutely no need for confusion regarding your requirements for a camshaft , and in the following we will cover the basics which will give you a good grounding in everything you need to know to make sure you don't wake up in the middle of the night worrying if your cam choice is correct or not!

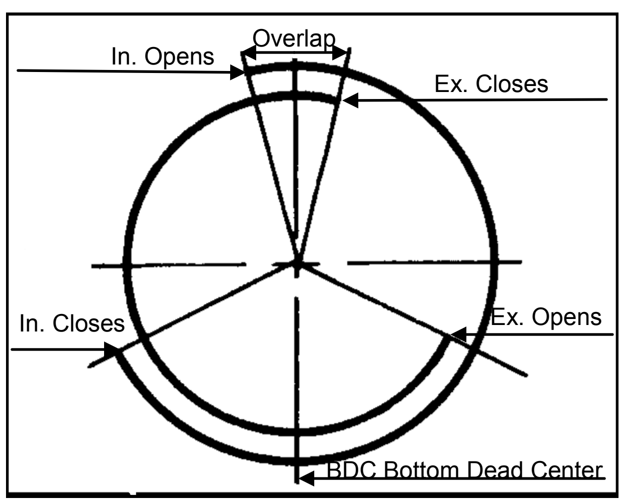
Cam Basics

1./ Lift: the easiest first. Measured from the base circle (or heel) to the very peak of the lobe, and then subtract the base circle diameter. Best done in the block if you can.
When represented by a graph this will be shown as the "displacement curve".

Total lift is fairly closely correlated to duration, and engines with a lifter diameter 0.800-0.812" (some Triumph & some BMC) these specs. fall roughly as follows:
Cam lift – factory 0.246-0.256", mild upgrade 0.260"-0.285", strong street performance 0.290"-0.315", vintage race 0.310"-0.330" race 0.320"-0.360"

2./ Duration: is measured in crankshaft degrees.
In fact it should be mentioned that the only cam related spec. that is not in crank degrees is lobe center angle (LCA), more on this in a moment.
"The smoke and mirrors syndrome" comes into play in the duration game, so we need to get this bit down.

Most times, reference to a cam is as 265 or a 285 for example, leading to the logical assumption that the second cam listed has 20 degrees more duration than the first.
Unfortunately, this assumption might be very wrong as an important piece of information is missing. A more accurate duration spec. is similar to a grid reference, meaning to say, if the numbers are missing on one side of the grid, then you could be anywhere.
Very simply, every duration number must also specify the distance from the base circle at which you start and finish figuring duration.



The most common specification started (1965) by my late friend and mentor Harvey Crane is the duration @ fifty thou. lift, and might look like this: 254@0.050"
If you understand the 'fifty' concept then this figure immediately gives a snap shot view of the cams performance.

It does not matter so much what lift figure is used as much as it has to be the same for however many cams you want to evaluate, then you are not comparing apples and oranges.

As with the lift groupings, durations can be grouped to give some idea of their performance specifications. Using the commonly quoted duration @ 0.050" lift: factory stock 190-205 (the most common BMC duration is 198@0.050"), mild street performance 210-225, high performance street 226-238, vintage race 238-254, full race 248-268.
Duration figures associated with BMC 'A' & 'B' series engines were most often quoted at 0.0158" (4mm) and the most common duration at that lift is 256 degrees. Another popular "lift from the base circle" duration is measured at 0.020".

DURATIONS

Intake: c:\HCI\OtherBup\DESIGNS\800-DIA\APT-M\APT-270M.S96
Exhaust: c:\HCI\OtherBup\DESIGNS\800-DIA\APT-M\APT-270M.S96

INTAKE .28000

Opening	Closing	Total	CAM Checking Height
166.69	166.69	333.38	.0040
135.00	135.00	270.00	.0158
130.01	130.01	260.02	.0200
116.61	116.61	233.22	.0400
112.00	112.00	224.00	.0500
94.11	94.11	188.22	.1000
78.08	78.08	156.16	.1500
60.44	60.44	120.88	.2000
36.69	36.69	73.38	.2500

This cam profile is a symmetrical design, and so the exhaust opening and closing is exactly the same as the intake shown here.
The "Total" column shows the duration for the specified checking heights.
Of note is the duration @0.0158" and @0.050"

36.01	Major Intensity	36.01
69.96	Minor Intensity	69.96
109.37	Hydraulic Intensity	109.37

Not covered in this info sheet, major intensity is an important figure as this allows camshaft comparisons in the opening and closing 'Ramp' area. This design is (18 opening—18 closing).

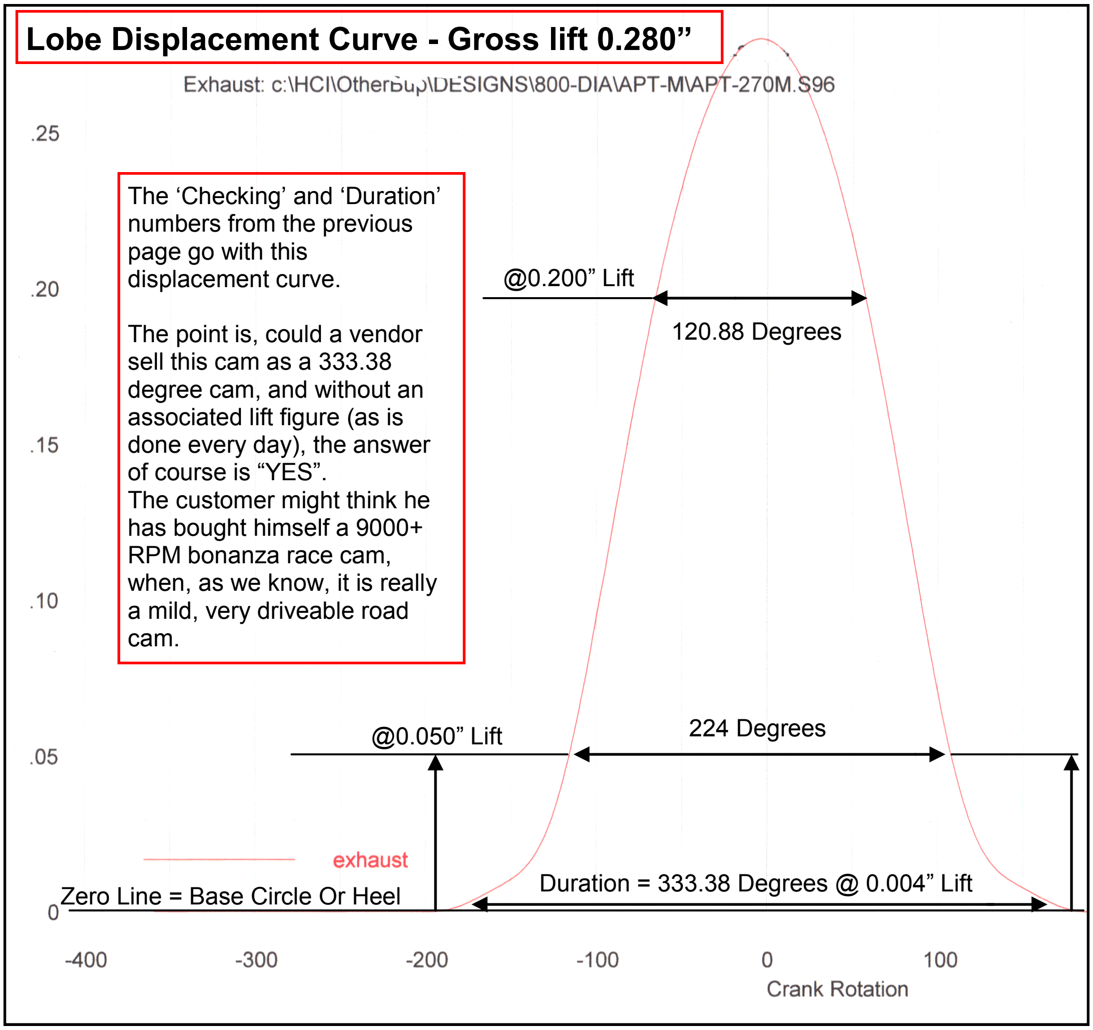
3./ The last of the three important items to know something about is "lobe center angle", this is the physical angle of an intake and exhaust pair, and just to add confusion LCA is also referred to as "lobe separation". A point to note is that this is the only figure connected with anything to do with camshafts that is in cam degrees, everything else is always referenced in crankshaft degrees.
Please note this is different from the term "lobe center line", LCL is in reference to timing the cam and is the same as "full lift on #1 intake @ ??? degrees after top dead center. (Please see our information pamphlet, "Installing & Timing Your Cam", available as a PDF download from our web site under the "How To" tab on the Home page).

The range of the LCA will normally fall in the range of 102 – 112 degrees. Only turbo or supercharger specific cams have a wider LCA usually 113 – 116 degrees.
The basic rule is that the tighter (smaller number) of the LCA the more overlap at the juncture of the closing of the exhaust valve and the opening of the intake, and so, conversely, the wider the separation the less overlap.
The basic effect of what might be termed a tighter LCA is that idle quality diminishes, the torque spread is tighter but generally will have more of a 'bump' in it. The consequence of this is that the top of the horse power curve arrives sooner and tips over faster. Race engines normally run 'tighter' LCA than road engines, but they also have longer duration to extend the power curve.
The wider LCA, 106+, will have a comparatively smoother idle, better fuel mileage, a horse power curve that 'hangs on longer', and a flatter torque curve.
Having a very wide LCA has also been mentioned with reference to a 'blower' motor, but there can be a couple more reasons for 'opening up' the LCA.

Firstly a couple more definitions: "single pattern cams" are cams where the duration is the same on intake and exhaust, and "dual pattern cams" have a longer duration lobe on the exhaust.
The longer exhaust duration of a dual pattern cam increase the overlap (greater time when both intake and exhaust are open together) compared to the 'single pattern cam' and usually requires the LCA to be spread at least one degree more.

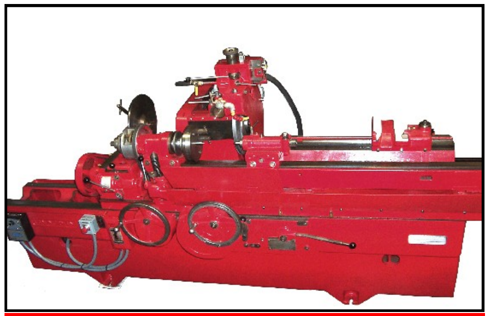
The second reason for opening up the LCA might be if you are changing to a higher ratio rocker, especially as we get up towards a 1.6 ratio.
While the degrees of overlap is a cam function and does not change, the 'valve open' area does due to the increased opening given by more ratio (more flow potential, but unfortunately often in the wrong direction!) of the valves during the overlap period. This increased LCA requirement can be as much as two degrees compared to a standard rocker ratio engine.

Siamese port engines like BMC 'A' & 'B' run with a tighter LCA than would be considered 'normal', compared to a domestic V8 for example. In fact the 'standard' BMC LCA from the factory is 107.5 degrees, and these cams are almost always 'dual pattern'.
If you are thinking 107.5 sounds a bit of an odd number, I think you are probably right, can you imagine the 'discussions' between the 107 and 108 camps, and their compromise agreement!



In practical terms, most cam offerings in today's aftermarket tend to be "single pattern", and we even have some race cams where exhaust duration is less than the intake. Having said all this about LCA I would also caution about taking any of this to the nth degree, and I can illustrate this by telling that when cam testing on the dyno we never make LCA changes of less than two degrees (cam degrees), and for that matter crank to cam timing changes of less than four degrees (crank degrees), because anything less is not accurately measurable in terms of torque and horse power, and even then requires 6 runs which the computer then averages.

There are pitfalls to look out for. An example, might be a cam that claims to be dual purpose.
A cam might be offered with a 110 degree LCA for normally aspirated or supercharger use. Sadly the result is not good for either application, too wide for normally aspirated, too tight for a 'blower'.



APT Van Norman 253 cam grinder. Basically a "copying" machine, the "smart" part is the master that it copies from, and hopefully the operator!

Please call anytime (best to call if you can) APT designs and grinds cams in house and as long as we don't get penned in a corner with regard to time, a custom grind is always possible if required.
Thank you, David Anton APT Riverside California USA

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APT Spring Specifications. Spring Set Part Number:**VPS-07**

Physical Dimensions

	Outer	Inner
Outside Diameter...	1.134"	0.812
Inside Diameter......	0.841"	0.615
Free Length............	1.731"	1.737
Wire Diameter........	0.145"	0.097

Physical Attributes & Associated Parts

Coil Bind Height........................	0.905"
Spring Rate Pounds Per Inch...	204
Engine Application..................	BMC 'A'
Associated Retainer(s)............	VSR-02

factory double spring retainer OK

Notes:

Typical cam association: VP266 & VP276
Next spring with a higher rate VPS-02 which requires retainer #VSR-01S

Len	Press
0.890	323
0.895	257
0.900	182
0.905	167
0.915	164
0.920	162
0.925	160
0.935	157
0.940	155
0.950	154
0.955	152
0.960	151
0.970	149
0.980	148
0.985	146
0.990	145
0.995	**143**
1.005	142
1.010	140
1.025	139
1.030	135
1.040	134
1.050	132
1.060	130
1.070	128
1.080	126
1.090	124
1.100	122
1.110	119
1.120	117
1.130	115
1.140	113
1.150	112
1.160	110
1.165	108
1.175	106
1.190	104
1.200	102
1.210	100
1.220	98
1.230	96
1.240	94
1.255	92
1.270	89
1.280	87
1.290	84
1.300	82
1.310	81
1.320	79
1.325	78
1.335	76
1.340	75
1.350	73
1.360	72
1.365	70
1.375	69
1.385	67
1.395	**66**
1.400	64
1.410	62
1.415	61
1.425	59
1.435	58
1.440	57
1.445	55
1.450	54
1.460	53
1.465	52
1.470	50
1.480	49
1.485	48
1.490	47
1.495	46
1.505	44
1.510	43
1.520	42
1.525	40
1.535	39
1.545	37
1.555	36
1.560	34
1.565	33
1.575	31
1.585	30
1.600	28
1.610	25
1.625	23
1.640	21
1.650	18
1.655	17
1.660	15
1.670	14
1.675	13
1.680	12
1.690	10
1.695	9
1.700	8
1.710	7
1.715	6
1.720	5
1.730	4
1.740	3
1.750	2

For this spring a typical installed height would be 1.395" as indicated in the high-lited line, with an installed seat pressure of 66 pounds To find the "over the nose" pressure subtract total valve lift from the installed height figure:
ie. 1.395 –0.400 (v/lift) = 0.995"