About Valve Springs

Valve Springs . . . Hardly An "Open & Shut" Subject!

Valve springs are at least as important as any other major performance component in an engine; yet, they are probably the most misunderstood and neglected. Incorrect or worn valve springs cause conditions that are often misdiagnosed as fuel or ignition problems. When all of the fuel and ignition system components have been replaced; and the "gremlins" are still in the engine, chances are the valve springs are either set up at the wrong tension, worn out, or just the wrong spring for the cam profile. This last factor is often the most puzzling, yet offers the greatest chance for significant improvements in engine performance.

Due to their highly stressed design (valve springs are coiled from specially heat-treated, super-clean, super-sophisticated alloys of steel), valve springs have several critical characteristics that are generally called "resonant frequency" or "natural harmonics". These are similar to those of a lead crystal goblet. By sounding a specific frequency musical note, the goblet will shatter. An undampened valve spring run at steady speed at its natural frequency will either self-destruct or lose enough of its strength and tension that it can no longer properly control the valve action.

At Crane, we design springs to maximize the performance of Crane Cams. In doing so, we put the resonant frequency outside of the intended operating range of the spring. This is not always the case, especially with springs produced by the OE manufacturers for production vehicles.

For years, especially before onboard computers, valve springs were used as "rev-limiters" to help the OE manufacturers in their efforts to minimize warranty problems caused by over-enthusiastic drivers. These springs usually had a resonant frequency located somewhere in the 4400-5200 RPM range. When a vehicle was accelerated, the engine would rev through the low end and mid-range perfectly until the engine speed hit somewhere in the 4400-5200 RPM range. Then it would either just stop pulling or the engine would start misfiring badly. This was typically diagnosed as a fuel or ignition problem when, in actuality, it was the factory's valve spring resonant frequency helping protect the engine.

A good set of valve springs, even on an otherwise stock engine, will usually provide a significant performance improvement throughout the RPM range as well as a marked improvement in fuel economy, smoother idle, improved cold start, and better cold weather driveability.

What is most important is selecting a valve spring with the correct seat pressure, open pressure, and spring rate for the camshaft in the engine. At Crane Cams, we constantly test and evaluate various cam lobe profiles vs. spring combinations, so that we can give you the right spring recommendations for your cam. However, with over 80,000 profiles in our camshaft lobe library and over 60 different valve springs in our catalog, it is impossible for us (or any company) to test every possible combination. Because of this, we offer guidelines on how to select springs for custom applications (special valve stem lengths, weights, etc.). It is in this area of the unknown or untested that the greatest opportunities exist of finding your own special combination that yields a power and performance increase beyond your competitors.

What we're talking about is virtually free HP just for choosing the right springs!

If you have purchased a cam (Crane or another brand), and it doesn't seem to perform to your expectations, it is quite likely a different valve spring might be able to make an improvement (It could also be a problem with pushrod stiffness and/or rocker arm geometry.) If you are pushing the envelope in any area of motorsports competition, it is necessary to constantly evaluate various combinations of engine components. Frequently, racers ignore the effects of the valve springs on the dynamics of the valvetrain. By experimenting with various valve spring combinations you will probably find the most power for your money and/or time. In addition, you just might cure that "fuel system" or "ignition system" problem you thought you had!

Valve Spring Rate and How to Use It

The rate of a spring is the force necessary to compress (or deflect) the spring a specified distance. For example, if we say that a spring has a rate of 250 lbs. per inch (250#/in.), it will take 250 pounds of force to compress the spring 1 inch. Fortunately, valve springs are coil springs, and coil springs are easy to understand because they have an almost linear spring rate. In other words, if it takes 400 lbs. to compress a spring 1 inch, it only takes 100 lbs. to compress the spring .250 in., 200 lbs. to compress it .500 in., and 300 lbs. to compress it .750 in. Some people refer to spring rate as "stiffness", and it is the understanding of this spring characteristic that is most important in selecting and setting up springs on an automotive cylinder head.

Frequently a taller, softer spring is a better choice for a performance application than a short, stiff spring.

Consider the following possibility:
A vehicle owner wants to use a .520" valve lift camshaft in an application and is considering different valve springs.

Spring A has an installed pressure of 125# at 1.750" installed height and has a rate of 280#/in.

Spring B has an installed pressure of 115# at 1.750" installed height with a rate of 410#/in.

At .520" lift, **Spring A** has an open pressure of 271# (this is 125# of seat pressure plus [.520" x 280#/in] = 146# from spring compression). At .520" lift, **Spring B** has an open pressure of 328# (this is 115# of seat pressure plus [.520" x 410#/in] = 213# from spring compression). Both of these springs would work on a street performance application requiring good performance and reliability. However, **Spring A** with a lower open pressure of 271# could probably be used on a cylinder head with pressed in rocker studs; while **Spring B** would definitely require screw in studs for adequate reliability. **Spring B** would probably provide better performance above 6000 RPM (especially with relatively heavy valves) because of its higher open pressure of 328#. **Spring A** would probably idle a little smoother with higher vacuum, especially if a high pressure oil pump or thicker oil is used. This is a result of **Spring A**'s higher seat pressure of 125#.

As you can see from the example above, there are often different springs that can offer different benefits on the same cam profile. **Spring A** offers good performance over a wide RPM range at a lower total valvetrain cost (this assumes that the heads were not machined for screw in studs). **Spring B** offers the possibility of somewhat improved performance beyond 6000 RPM. The vehicle owner needs to decide what he wants from his vehicle and what he wants to spend.

In all-out racing, we frequently see the need for different springs on the same lobe profile depending on the anticipated RPM range. Frequently, circle track racers will run two different tracks with the same engine but with different rear end gearing. Often there can be as much as 500-700 RPM difference in the top end engine speed between the two tracks. It is not uncommon to find that the car runs better on the track with the lower peak RPM using a spring with a lower seat pressure and softer rate. At the track where the engine runs to the higher speed, the engine needs more seat pressure and a stiffer spring rate. Every combination of engine, chassis, and track is different. Significant performance improvements can often be achieved by experimenting with valve springs. If you aren't paying attention to your springs, the guy winning most of the races probably is!

Choosing Valve Springs

How to Select a Valve Spring

With the many choices of aftermarket cylinder heads, most with longer-than-stock length valves, the recommendation of a specific spring for a specific cam is almost impossible. It is now necessary to select the spring that will best fit the cylinder head configuration. We offer the following as general guidelines only:

1) "FLAT FACED LIFTER" cam/lifter applications (Street & Street/Strip) seat pressures

a. Small Block: 105-125# Seat Pressure
b. Big Block: 115-130# Seat Pressure (Note: Big Block applications need higher seat pressures due to their larger, heavier valves.)

2) "FLAT FACED LIFTER" Open pressures should not exceed 330# open pressure (sustained after spring break-in for accepable cam and lifter life.

a. Open pressures should be a minimum of 220# for applications up to 4000 RPM.
b. For good performance above 4000, open pressures should be at least 260# with stock weight valves. (Lightweight valves require less spring open pressure.)
c. Spring open pressures over 280# can cause pressed-in studs to come loose; therefore, we recommend screw-in studs for open pressures above 280#.

3) HYDRAULIC ROLLER CAMS require higher spring seat pressures to control the heavier roller tappets and the more aggressive opening and closing rates available to roller cam profiles.

a. Small Block applications: 120-145# seat pressure
b. Big Block applications: 130-165# seat pressure

4) HYDRAULIC ROLLER CAMS use higher open pressures to control the high vertical opening inertia of the heavier roller followers.

a. Small Block applications need at least 260# for general driving applications up to 4000 RPM.
b. Moderate performance small block applications like 300-360# open.
c. Serious small block applications can tolerate 400-425#* open pressures and still expect reasonable valve train life when top quality springs, pushrods, and lubricants are used.
d. Big Block applications need at least 280# for general driving applications up to 4000 RPM.
e. Moderate performance big block applications like 325-375# open pressure.
f. Serious big block performance applications can tolerate 450#* open pressure and still expect reasonable valve train life when top quality springs, pushrods, and lubricants are used.

*Note: Open pressures in excess of 360# require the use of roller tappet bodies made of billet steel. Crane hydraulic roller and solid roller tappets are made from heat treated steel billet to withstand the stresses of high-performance use. Most stock hydraulic roller tappet bodies are made of cast iron and cannot tolerate high spring loads.

5) MECHANICAL ROLLER CAM/LIFTER

Applications are generally for serious street/strip use and full competition. Most are not used in daily-drivers where day-to-day reliability is stressed. Instead, most of these cams are intended for winning performance. These cams are designed with very aggressive opening and closing rates. High seat pressures are necessary to keep the valves from bouncing when they come back to the seat. In all cases, the valve action and spring pressures required mandate the use of high-strength, one-piece valves. However, Crane does offer the SR-Series of Street Roller camshafts intended for daily usage.

a. **Seat Pressures** are determined by valve/retainer weight, engine RPM and life expectancy of components before replacement is required. Milder roller cams require 165# on the seat as an absolute minimum. 180-200# is common for most modest performance applications. 220-250# is common for most serious sport categories and some circle track professional categories. Pro-Stock and Blown Alcohol/Fuel drag applications use as much as 340-500# on the seat.

b. **Open Pressures** need to be high enough to control the valvetrain as the lifter goes over the nose of the cam. Ideally, the minimum amount of open pressure to eliminate or minimize valvetrain separation is desired. Any excess open pressure only contributes to pushrod flex, which can aggravate valvetrain separation. For serious racing applications this can be determined only by experimentation and track testing. For general guidelines we offer the following
   i. Street/Strip performance with long cam/lifter life desirable, 350-450# open.
   ii. Circle track and moderate bracket racing 450-600@ open.
   iii. Serious drag racing and limited distance circle track racing 600# and more.

Single Valve Springs

O.D	I.D.	Damper	Seat Press.	Open Press.	Coil Bind	Rate (lbs/in.)	Max Net Lift	Application	Part No.
1.000	0.730	No	62 lbs @1.475	130 @ 1.025	0.910	151 lbs/in.	0.475	Ford Duratec 1.8 – 2.3 litre DOHC 4V 4 cyl. included in **903-2007** valve spring and retainer kit.	**96845-16**
Top: 0.930 Bottom: 1.025	0.567 0.662	No	90 lbs @1.470	252 @ .970	0.900	324 lbs/in.	0.500	Ford Modular 4.6 – 5.4 litre DOHC 4V V-8 beehive, ovate wire.	**40830-32**
1.065	0.725	No	60 lbs @1.535	255 lbs @ 1.063	0.987	413 lbs/in.	0.500	Chrysler/Dodge Neon DOHC I-4	**180830-16**
1.065	0.725	No	85 lbs @1.535	244 lbs @ 1.135	1.014	398 lbs/in.	0.470	Chrysler/Dodge Neon SOHC I-4	**158830-16**
Top: 0.967 Bottom: 1.096	0.636 0.765	No	85 lbs @1.640	250 @ 1.040	1.000	275 lbs/in.	0.620	Ford 4.6-5.4L 2 valve & 3 valve V-8 beehive, ovate wire.	**37830-16**
1.255	0.870	Yes	114 lbs @1.700	340 @ 1.200	1.153	432 lbs/in.	0.487	Small Block Chevy Street/Strip: RV/Truck Power. Stock dia spring for 1.700" installed ht. .480" max recommended valve lift.	**99848-16**
1.255	0.870	No	124 lbs @1.750	374 @ 1.150	1.100	409 lbs/in.	0.640	Late Model LT-1 w/aluminum heads; LS1 or other alum. heads w/1.770-1.820" inst. hts. **XHTCS**	**99845-16**
1.255	0.870	Yes	125 lbs @ 1.800	383 @ 1.200	1.100	428 lbs/in.	0.640	SB Chevy apps. up to .600" valve lift with stock spring seats. Flat tappets install @ 1.800"; hyd rlr install @ 1.750-1.800" **XHTCS**	**99846-16**
1.260	0.876	Yes	107 lbs @ 1.800	348 @ 1.200	1.110	395 lbs/in.	0.600	SB Chevy hyd rlr w/1.750" installed ht. SB Chevy flat tappet w/1.770-1.800" inst. ht.	**96802-16**
1.265	0.865	No	120 lbs @ 1.750	358 @ 1.250	1.100	476 lbs/in.	0.600	SB Chevy/LS1/LS2 Performance hydraulic roller cams, PAC enhanced wire	**144845-16**
1.265	0.775	Yes	125 lbs @ 1.750	388 @ 1.250	1.100	526 lbs/in.	0.600	SB Chevy/LS1/LS2 Performance hydraulic roller cams, PAC enhanced wire	**144846-16**
Top: 1.055 Bottom: 1.290	0.650 0.885	No	130 lbs @ 1.800	318 @ 1.200	1.140	313 lbs/in.	0.600	LS1/LS2 Performance hydraulic roller cams beehive, ovate wire.	**99831-16**
1.410	1.026	Yes	80 lbs @ 1.550	218 @ 1.150	0.938	345 lbs/in.	0.552	Ford 2.3L SOHC	**99842-8**
1.435	1.035	Yes	107 lbs @ 1.700	317 @ 1.150	1.037	330 lbs/in.	0.600	Various Ford 302-351W V-8's, Ford 300 6cyl, Mopar 360's and Olds 350/400/455	**96803-16**
1.437	1.077	Yes	104 lbs @ 1.750	229 @ 1.150	1.069	204 lbs/in.	0.620	Ford V-8 RV and mild street appls. Used w/**96840, 96842, 96843** for various hyd roller and flat tappet street/strip and bracket apps.	**96806-16**
1.440	1.040	No	98 lbs @ 1.700	260 @ 1.200	1.080	328 lbs/in.	0.560	AMC 6cyl; SB Ford; Olds V-8's; Street/Strip, RV/Truck Power applications.	**99833-16**
Top: 1.095 Bottom: 1.445	0.650 1.000	No	155 lbs @ 1.880	377 @ 1.280	1.210	370 lbs/in.	0.650	Big Block Chevy and LS7, and FE Ford, beehive, nitrided ovate wire.	**99832-16**
Top: 1.295 Bottom: 1.450	0.859 1.014	No	118 lbs @ 1.950	375 @ 1.380	1.320	457 lbs/in.	0.580	Ford 5.0/351W Street/Strip, RV/Truck Power, Beehive	**99841-16**
1.460	1.060	Yes	110 lbs @ 1.550	303 @ 1.100	0.935	442 lbs/in.	0.605	Many Pontiac V-8 Street/Strip applications	**99840-16**
1.460	1.060	Yes	114 lbs @ 1.800	287 @ 1.250	1.139	310 lbs/in.	0.600	Ford V-8's w/1.770-1.850" installed hts. Used w/**96840** and **96842** for High Perf hyd rlrs and solid flat tappet cams.	**96801-16**
1.500	1.086	Yes	113 lbs @ 1.600	280 @ 1.150	1.000	412 lbs/in.	0.565	SB Chrysler; Street/Strip; RV/Truck Power	**99835-16**
1.500	1.086	Yes	121 lbs @ 1.800	298 @ 1.300	1.130	354 lbs/in.	0.660	AMC V-8; BB Chevy w/1.880" installed ht: Street/Strip, RV/Truck Power.	**99839-16**
1.539	1.125	Yes	129 lbs @ 1.950	358 @ 1.200	1.130	312 lbs/in.	0.700	BB Chevy and BB Chrysler hyd rlr and High Perf flat tappet cams. Use +.050" keepers. Used with **96843**, **96844** inners for several mech roller cams.	**96807-16**

Inner Valve Springs

The Inner Springs shown below are available separately for "Mix-and-Match" Dual Spring Combinations using "96" part number prefix single valve springs. See specific "96" Dual Springs for correct components. These Inner Springs are not recommended for use with "99" prefix springs. Sold in sets of 16.

0.937	0.697	No	29 lbs @ 1.600	90 @ 1.000	0.925	96 lbs/in.	0.615	For use with **96801, 96806,** Outer Valve Springs	**96842-16**
0.953	0.697	No	54 lbs @ 1.500	130 @ 1.000	0.916	132 lbs/in.	0.500	For use with **96806, 96807,** Outer Valve Springs	**96843-16**
0.970	0.700	No	51 lbs @ 1.750	134 @ 1.150	1.014	135 lbs/in.	0.676	For use with **96801, 96806** Outer Valve Springs	**96840-16**
1.015	0.731	No	57 lbs @ 1.800	160 @ 1.150	1.045	155 lbs/in.	0.650	For use with **96807** Outer Valve Springs	**96844-16**

O.D	I.D.1	I.D.2	Damper	Seat Press.	Open Press.	Coil Bind	Max Net Lift w /.060" clearance	Rate (lbs/in.)	Application	Part No.
Dual Valve Springs										
1.212	0.900	0.674	No	93 lbs @ 1.550	266 @ .950	0.865	0.625	290 lbs/in.	Buick V-6 & Buick 350 V-8	**99891-16**
1.218	0.906	0.680	No	91 lbs @ 1.300	220 @ .900	0.783	0.457	337 lbs/in.	Early Ford 2.0L SOHC & VW liquid cooled	**99879-8**
1.237	0.925	0.655	No	137 lbs @ 1.800	377 @ 1.150	1.080	0.650	369 lbs/in.	LS1/LS2 Performance hydraulic roller and mechanical roller camshafts.	**144833-16**
1.275	0.937	0.667	No	112 lbs @ 1.800	352 @ 1.150	1.045	0.650	352 lbs/in.	LS1 Performance hydraulic roller cams	**144832-16**
1.304	0.980	0.754	No	96 lbs @ 1.650	230 @ 1.150	0.927	0.663	215 lbs/in.	Nissan 4 cyl; Ford 2.3L SOHC	**99884-8**
1.344	1.000	0.730	No	107 lbs @ 1.820	274 @ 1.300	1.057	0.703	334 lbs/in.	Small Block Chevy 87-91 L98 and Fast Burn alum. heads w/hydraulic roller cams	**96887-16**
1.437	1.080	0.697	Yes	134 lbs @ 1.750	283 @ 1.250	1.185	0.600	296 lbs/in.	Several SB Chevy, SB Ford flat tappet and hyd rlr apps. **(96806 outer/96842 inner)**	**96873-16**
1.437	1.080	0.697	Yes	128 lbs @ 1.800	328 @ 1.200	1.115	0.625	322 lbs/in.	Various hyd rlr & flat tappet street perf. & mild bracket racing. **(96806 outer/96843 inner)**	**96874-16**
1.437	1.080	0.700	Yes	131 lbs @ 1.850	345 @ 1.200	1.110	0.680	326 lbs/in.	SB Chevy & SB Ford hyd rlrs and flat tappet bracket racing w/long valves or tall assy hts. **(96806 outer/96840 inner)**	**96872-16**
1.449	1.075	0.794	No	120 lbs @ 1.875	394 @ 1.175	1.035	0.625	392 lbs/in.	Hydraulic and mechanical flat faced lifter camshafts, mild hydraulic roller camshafts.	**99892-16**
1.460	1.060	0.697	Yes	126 lbs @ 1.850	366 @ 1.250	1.175	0.615	404 lbs/in.	BB Ford and BB Chrysler hyd rlr and flat tappet street/strip use. **(96801 outer/96842 inner)**	**96877-16**
1.460	1.075	0.803	No	130 lbs @ 1.850	402 @ 1.150	1.080	0.710	391 lbs/in.	BB Chevy, BB Ford, BB Chrysler premium RV/ Truck Power applications. Flat tappet racing use.	**99893-16**
1.460	1.060	0.700	Yes	134 lbs @ 1.900	424 @ 1.250	1.154	0.686	448 lbs/in.	High perf hydraulic rollers; Sportsman flat tappet racing, moderate perf solid rollers **(96801 outer/96840 inner)**	**96870-16**
1.465	1.091	0.807	No	112 lbs @ 1.650	336 @ 1.100	0.950	0.690	438 lbs/in.	AMC 6 cyl, Buick V-8's, many perf cams with short assy hts requiring high lifts and moderate spring rate	**99838-16**
1.500	1.050	0.726	No	300 lbs @ 2.100	1002 @ 1.200	1.130	0.900	780 lbs/in.	Small diameter, low mass, all-out race, Nano-Peened™, Pacaloy wire.	**961356-16**
1.500	1.050	0.726	No	420 lbs @ 2.175	1200 @ 1.175	1.130	1.000	780 lbs/in.	Small diameter, low mass, high lift drag race, Nano-Peened™, Pacaloy wire.	**961355-16**
1.522	1.050	0.726	No	400 lbs @ 2.250	1252 @ 1.300	1.190	0.950	895 lbs/in.	Small diameter, low mass, all-out race, Nano-Peened™, Pacaloy wire.	**961360-16**
1.530	1.116	0.766	Yes	131 lbs @ 1.900	410 @ 1.250	1.160	0.630	428 lbs/in.	BB Chevy hyd and solid flat tappet racing; BBC, BB Ford, & Ford 351/400 hyd rlr cams	**99890-16**
1.539	1.125	0.697	Yes	160 lbs @ 1.900	424 @ 1.300	1.145	0.700	444 lbs/in.	BB Chevy and BB Chrysler solid street rollers or hyd rlrs w/+.050" taller inst. ht. **(96807 outer/96843 inner)**	**96879-16**
1.539	1.125	0.731	Yes	200 lbs @ 1.900	508 @ 1.250	1.152	0.680	480 lbs/in.	Various solid rlr applications for Pro Street & bracket use **(96807 outer/96844 inner)**	**96878-16**
1.540	1.140	0.754	Yes	144 lbs @ 1.900	403 @ 1.300	1.175	0.665	434 lbs/in.	Various Big Block hyd rlr applications	**99895-16**
1.540	1.140	0.760	Yes	150 lbs @ 1.900	560 @ 1.150	1.135	0.755	528 lbs/in.	Various Big Block hyd rlr apps. Harmonics optimized for sustained high RPM marine use. Solid flat tappets with tall assembly hts.	**99896-16**
1.540	1.115	0.729	Yes	224 lbs @ 1.950	638 @ 1.200	1.130	0.760	544 lbs/in.	Professional roller cam race applications Electro-Polished	**96883-16**
1.550	1.100	0.706	Yes	275 lbs @ 2.000	805 @ 1.200	1.150	0.800	663 lbs/in.	Various Small and Big Block roller camshafts, drag racing	**961226-16**
1.550	1.100	0.788	No	250 lbs @ 2.000	765 @ 1.200	1.150	0.800	644 lbs/in.	High rate dual spring for aggressive valve train. Premium circle track, Nano-Peened™, PAC enhanced wire.	**961325-16**
1.550	1.100	0.706	Yes	275 lbs @ 2.000	805 @ 1.200	1.150	0.800	662 lbs/in.	High rate dual spring with damper for aggressive valve train. Premium circle track, Nano-Peened™, PAC enhanced wire.	**961326-16**
1.550	1.050	0.726	No	425 lbs @ 2.300	1440 @ 1.300	1.230	1.000	1015 lbs/in.	Small diameter, low mass, high lift drag race, Nano-Peened™, Pacaloy wire.	**961354-16**
1.551	1.119	0.709	Yes	226 lbs @ 2.000	717 @ 1.250	1.150	0.790	652 lbs/in.	Drag Race & Circle Track roller cams w/1.950-2.000" installed hts	**96886-16**

O.D	I.D.1	I.D.2	Damper	Seat Press.	Open Press.	Coil Bind	Max Net Lift w /.060" clearance	Rate (lbs/in.)	Application	Part No.
Dual Valve Springs										
1.555	1.130	0.743	Yes	256 lbs @ 2.000	652 @ 1.250	1.178	0.762	510 lbs/in.	Professional roller cam race applications Electro-Polished	**96884-16**
1.565	1.146	0.740	Yes	190 lbs @ 1.950	552 @ 1.250	1.200	0.690	504 lbs/in.	Solid street rollers/Bracket racing; Hi Perf big block hyd rlrs w/tall assy hts.	**99876-16**
1.565	1.129	0.749	Yes	215 lbs @ 1.950	685 @ 1.200	1.121	0.769	618 lbs/in.	Bracket Race & Circle Track Roller Cams XHTCS Spring	**99885-16**
1.593	1.154	0.741	Yes	254 lbs @ 2.050	687 @ 1.280	1.220	0.780	576 lbs/in.	Professional circle track endurance, ID chamfered coils, radiused damper ends, PAC enhanced wire.	**96885-16**
1.625	1.175	0.851	No	280 lbs @ 2.100	847 @ 2.100	1.100	0.900	629 lbs/in.	Bracket Race applications with hight lift / agressive valve train and RPM requirements, Pacaloy wire.	**961228-16**
1.625	1.175	0.769	Yes	244 lbs @ 2.000	801 @ 1.150	1.090	0.850	656 lbs/in.	Drag Race roller cams with approx. 2.00" inst hts. **XHTCS**	**99880-16**
1.625	1.175	0.769	Yes	250 lbs @ 2.050	673 @ 1.300	1.210	0.750	564 lbs/in.	Various Big Block roller camshafts, lower lift bracket racing, PAC enhanced wire.	**961299-16**
1.625	1.175	0.851	No	275 lbs @ 2.000	810 @ 1.150	1.100	0.850	625 lbs/in.	Various Big Block roller camshafts, high lift bracket racing, PAC enhanced wire.	**961224-16**
Triple Valve Springs										
1.645	1.195	0.635	No	250 lbs @ 2.050	801 @ 1.250	1.130	0.800	689 lbs/in.	Various Big Block roller camshafts, high lift bracket racing, PAC enhanced wire.	**961246-16**
1.645	1.195	0.635	No	290 lbs @ 2.070	835 @ 1.270	1.130	0.800	682 lbs/in.	Various Big Block roller camshafts, high lift bracket racing, Nano-Peened™, PAC enhanced wire.	**961347-16**
1.645	1.195	0.635	No	332 lbs @ 2.100	950 @ 1.200	1.130	0.900	688 lbs/in.	Various Big Block roller camshafts, high lift bracket racing, Nano-Peened™, PAC enhanced wire.	**961348-16**
1.667	1.195	0.635	No	300 lbs @ 2.100	963 @ 1.250	1.135	0.850	780 lbs/in.	Various Big Block roller camshafts, high lift bracket racing, PAC enhanced wire.	**96888-16**
1.675	1.203	0.634	No	362 lbs @ 2.100	1035 @ 1.200	1.161	0.879	684 lbs/in.	Pro Drag Racing including blown alcohol & fuel	**96848-16**
1.675	1.203	0.634	No	352 lbs @ 2.200	1024 @ 1.200	1.161	0.979	690 lbs/in.	Pro Drag Racing including blown alcohol & fuel	**96849-16**

More Valve Train Questions

What is Valve Spring Coil Bind and how does it relate to Spring Travel and Valve Lift?

When the valve spring is compressed until its coils touch one another and can travel no further, it is said to be in coil bind. The catalog (pages 337 to 339) shows the approximate coil bind height for the various Crane Cams valve springs. To measure this you must install the retainer in the valve spring, then compress the spring until it coil binds. Now measure from the bottom side of the retainer to the bottom of the spring. This measurment is the coil bind height. (See Figure 1) This can be done on the cylinder head with a spring compression tool in a bench vise, or in a professional valve spring tester.

Using Figure 1, subtract the coil bind height "B" from the valve spring installed height "A". The difference "C" is the maximum spring travel. The spring travel is usually at least .060" greater than the full lift of the valve. This safety margin of .060" (or more) is necessary to avoid the dangers of coil bind and over-stressing the spring.

If coil bind occurs, the resulting mechanical interference will severely damage the camshaft and valvetrain components.

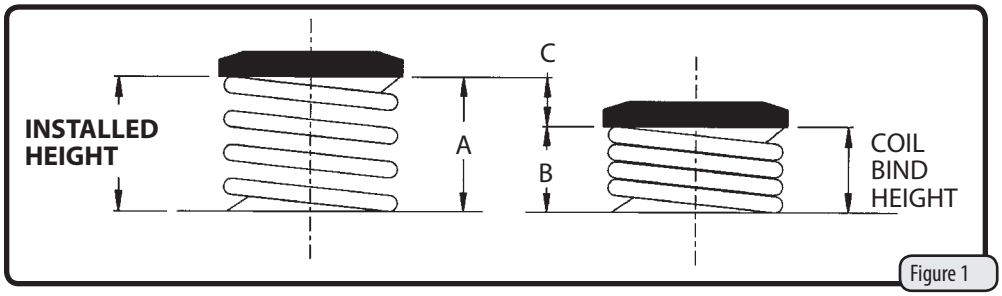

Figure 1

Valve Spring Spec Chart

BOLD Numbers are recommended closed pressures @ installed height.

Spring Type	Single	Single	Single	Single	Single	Single	Single	Single	Single	Single
O.D.	1.000	1.065	1.065	1.025/0.930	1.096/0.967	1.255	1.255	1.255	1.260	1.265
I.D.	0.730	0.725	0.725	0.662/0.567	0.765/0.636	0.870	0.870	0.870	0.876	0.865
Damper	No	No	No	No	No	Yes	No	Yes	Yes	No
Installed Height	1.475	1.535	1.535	1.470	1.640	1.700	1.750	1.800	1.800	1.750
Coil Bind	0.910	0.987	1.014	0.900	1.000	1.153	1.100	1.100	1.110	1.100
Spring Rate (lbs/in.)	151	413	398	324	275	432	415	428	395	476
Max. Net. Lift	0.475	0.500	0.470	0.500	0.600	0.487	0.640	0.640	0.600	0.600
Part No.	**96845**	**180830**	**158830**	**40830**	**37830**	**99848**	**99845**	**99846**	**96802**	**144845**
2.300										
2.250										
2.200										
2.150										
2.100										
2.050										
2.000										
1.950										
1.900										
1.850								104		72
1.800						81	103	**125**	**107**	96
1.750						100	**124**	147	125	**120**
1.700					69	**114**	145	169	144	144
1.650					82	137	165	190	162	168
1.600					96	158	187	213	181	191
1.550		54	79	64	110	179	208	235	199	215
1.500	58	74	94	80	124	201	228	256	220	239
1.450	66	95	114	96	137	222	249	278	238	263
1.400	74	115	134	113	151	243	270	299	258	287
1.350	81	136	154	129	165	265	290	321	280	310
1.300	89	156	173	145	179	287	311	342	302	334
1.250	96	177	193	161	192	313	332	363	325	358
1.200	104	197	213	177	206	340	353	383	248	382
1.150	111	218	233	194	220		374	405		406
1.100	119	238	253	210	234					
1.050	126	259		226	247					
1.000	134			242	261					
0.950	142			258						
0.900										

Popular Recommended Components

Steel Retainers (see page 350)						**99915 99916**	**99914**	**99915 99916**	**99915 99916**	**99915 99916**
Titanium Retainers 7° (see page 351)	**905-0003**	**158660**	**158660**	**40660**	**37660**					
Titanium Retainers 10° (see page 351)										
Spring Seats (see page 362)										

Valve Spring Spec Chart

BOLD Numbers are recommended closed pressures @ installed height.

Spring Type	Single	Single	Single	Single	Single	Single	Single	Single
O.D.	1.265	1.290/0.885	1.410	1.435	1.437	1.440	1.445/1.095	1.450/1.295
I.D.	0.865	1.055/0.650	1.026	1.035	1.080	1.040	1.000/0.650	1.014/0.859
Damper	Yes	No	Yes	Yes	Yes	No	No	No
Installed Height	1.750	1.800	1.550	1.700	1.750	1.700	1.880	1.950
Coil Bind	1.100	1.140	0.938	1.037	1.069	1.080	1.210	1.139
Spring Rate (lbs/in.)	526	313	318	330	204	328	370	457
Max. Net. Lift	0.600	0.600	0.552	0.600	0.620	0.560	0.650	0.580
Part No.	**144846**	**99831**	**99842**	**96803**	**96806**	**99833**	**99832**	**99841**
2.300								
2.250								
2.200								
2.150								
2.100								
2.050								
2.000								95
1.950							129	**118**
1.900		99					148	141
1.850	73	114			86		166	164
1.800	99	**130**			96		185	187
1.750	**125**	146		91	**104**	83	203	209
1.700	151	161		**107**	113	**98**	222	232
1.650	177	177		123	122	113	240	255
1.600	204	193	70	132	130	128	259	278
1.550	230	208	**86**	148	140	143	277	301
1.500	256	224	102	164	150	159	296	324
1.450	282	240	117	181	160	174	314	347
1.400	308	255	132	198	171	189	333	369
1.350	335	271	148	215	181	205	351	392
1.300	361	287	164	234	192	222	370	415
1.250	388	302	179	251	203	239	388	438
1.200	413	318	194	272	215	256		461
1.150	439		210	289	229	274		
1.100			226	317	240	293		
1.050			245					
1.000			264					
0.950								
0.900								

Popular Recommended Components

Steel Retainers (see page 350)	**99915** **99916**	**99976**		**99946** **99969**	**99936** **99944**	**99936** **99944**	**99976**	**99942**
Titanium Retainers 7° (see page 351)		**99639**					**99637**	
Titanium Retainers 10° (see page 351)						**99630**		
Spring Seats (see page 362)								

Valve Spring Spec Chart

BOLD Numbers are recommended closed pressures @ installed height.

Spring Type	Single	Single	Single	Single	Single	Single	Single	Single
O.D.	1.460	1.460	1.500	1.500	1.539	0.937	0.953	0.970
I.D.	1.060	1.060	1.086	1.086	1.125	0.697	0.697	0.700
Damper	Yes	Yes	Yes	Yes	Yes	No	No	No
Installed Height	1.550	1.800	1.600	1.800	1.950	1.600	1.500	1.750
Coil Bind	0.935	1.139	1.000	1.130	1.130	0.925	0.916	1.014
Spring Rate (lbs/in.)	442	310	412	354	312	96	132	135
Max. Net. Lift	0.605	0.600	0.565	0.660	0.700	0.615	0.500	0.676
Part No.	**99840**	**96801**	**99835**	**99839**	**96807**	***96842**	***96843**	***96840**
2.300								
2.250								
2.200								
2.150								
2.100								
2.050								
2.000					115			
1.950		75			**129**			
1.900		88		86	136			
1.850		101		102	149			38
1.800		**114**		**121**	162			45
1.750		128		138	177	14		**51**
1.700		143		155	192	19		58
1.650		157	92	172	207	23		63
1.600	91	171	**113**	189	222	**29**	42	70
1.550	**110**	186	133	206	237	32	48	76
1.500	131	201	154	224	252	37	**54**	83
1.450	151	218	174	242	269	42	60	90
1.400	171	235	195	260	286	47	66	97
1.350	191	252	215	279	302	51	73	105
1.300	212	269	234	298	318	56	80	112
1.250	233	287	256	320	338	61	87	120
1.200	255	304	277	338	358	66	94	127
1.150	279		298	359		71	102	134
1.100	303		319			76	111	
1.050	328		342			82	120	
1.000	352		364			90	130	
0.950	378							
0.900								

Popular Recommended Components

Steel Retainers (see page 350)	**99936** **99944**	**99936** **99944**	**99936** **99944**	**99936** **99944**	**99962** **99970**			
Titanium Retainers 7° (see page 351)								
Titanium Retainers 10° (see page 351)	**99630**		**99630**	**99630**				
Spring Seats (see page 362)	**99457**		**99459**	**99459**				

*** Denotes Inner Spring**

Valve Spring Spec Chart

BOLD Numbers are recommended closed pressures @ installed height.

Spring Type	Single	Dual	Dual	Dual	Dual	Dual	Dual	Dual
O.D.	1.015	1.212	1.218	1.237	1.275	1.304	1.344	1.437
I.D.	0.731	0.674	0.680	.0655	0.667	0.754	0.730	0.697
Damper	No	No	No	No	No	No	No	Yes
Installed Height	1.800	1.550	1.300	1.800	1.800	1.650	1.800	1.750
Coil Bind	1.045	0.865	0.783	1.080	1.045	0.927	1.057	1.185
Spring Rate (lbs/in.)	155	290	337	369	352	215	334	296
Max. Net. Lift	0.650	0.625	0.457	0.650	0.650	0.663	0.710	0.600
Part No.	***96844**	**99891**	**99879**	**144833**	**144832**	**99884**	**96887**	**96873**
2.300								
2.250								
2.200								
2.150								
2.100								
2.050								
2.000								
1.950	33							
1.900	41			100	78			
1.850	49			119	95			106
1.800	**57**			**137**	**112**		**114**	120
1.750	64			155	129	76	129	**134**
1.700	72			174	147	86	144	148
1.650	80	**66**		192	164	**96**	160	162
1.600	88	79		211	182	107	176	175
1.550	95	93		229	199	118	192	189
1.500	103	107		248	218	128	208	204
1.450	111	121		266	236	139	224	219
1.400	119	135		285	254	150	240	234
1.350	126	148	76	303	273	161	257	250
1.300	134	162	**91**	322	292	172	274	267
1.250	143	176	106	340	311	184	292	283
1.200	151	190	122	358	330	195	310	299
1.150	160	204	137	377	352	206	330	
1.100		219	152		375	218	350	
1.050		234	168			230		
1.000		250	184					
0.950		266	202					
0.900		284	220					

Popular Recommended Components

Steel Retainers (see page 350)	**99912** **99916**	**99926**	**99975**	**99975**	**99967**	**99935**	**99944** **99969**
Titanium Retainers 7° (see page 351)			**144661**	**99657** **144661**			**99669**
Titanium Retainers 10° (see page 351)							**99630**
Spring Seats (see page 362)							**99465**

*** Denotes Inner Spring**