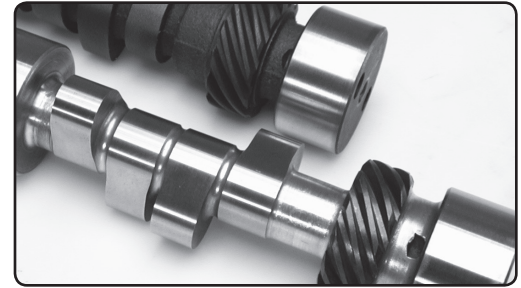


CROWER

Important:
Flat Tappet Camshaft & Lifter
Installation Information



THE BEAST IS BACK



PERFORMANCE cams
at an AFFORDABLE price

1. Crower Camshaft & Lifter Guide	3
2. Break-in Lubrication	5
3. Hydraulic Lifter Installation	7
4. Valve Springs	8
5. Proper Valve Train Geometry	11
6. Camshaft Installation Check List	13
7. Degreasing your Camshaft for Maximum Performance	15

Cam Part No.
(or work order No.) _____

Installation Date: _____

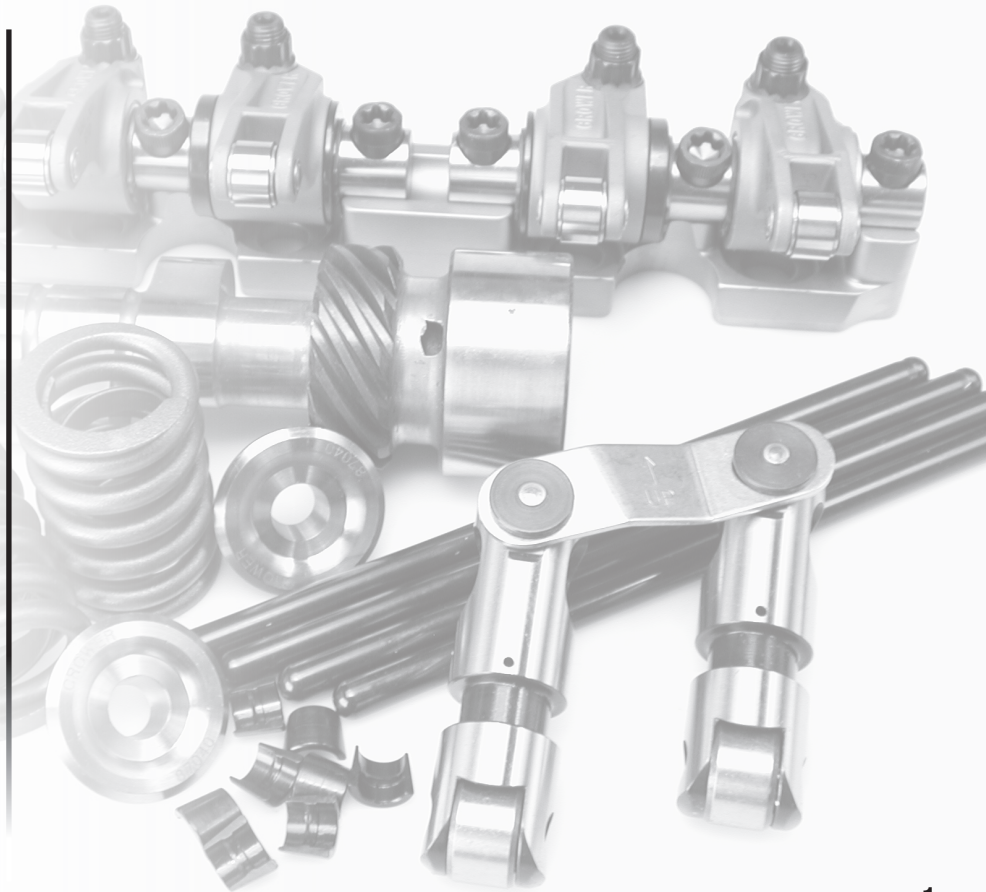
Mileage: _____

Installed with Lifter Part Number: _____

Warranty No.: _____

Date Purchased: _____

Sales Associate: _____



Introduction

Before You Begin

Crower stands behind each and every product we produce. Since 1955, utilizing innovative design and engineering, strict quality control manufacturing standards, and the highest quality materials, we've built a reputation for supplying the best performing, race proven components money can buy.

Our commitment to craftsmanship and excellence goes into every product we sell as we continue to provide our customers the performance and power that has been turning heads for decades.

However, the warranties on our vast product line will vary due to intended use, individual application, installation procedures and other variables. Please complete warranty registration for your camshaft online at:
www.crower.com/index.php/warranty/

Crower Valve Springs & Retainer Kits are performance matched to Crower camshafts and are highly recommended and required for full warranty benefits of your new Crower Performance Camshaft. All flat tappet camshafts are shipped with assembly lubricant and we also highly recommend ZDDPlus™ (Crower Part # 86092) be added to your engine before the break-in process is begun. No dealer, jobber or warehouse is authorized to handle warranty claims directly.

This booklet is a general installation reference guide for Crower valve train components. The information is intended to give you a good basic idea of what building a reliable and powerful performance valve train requires.

We've tried to eliminate the "surprises" and provide you with solutions to any snags you might encounter. It should help minimize your anxiety when there's more to a job than you planned on, or when parts don't fit properly.

Most of the information is based on common sense. However, in presenting the following tips, do's and do not's, we have assumed you have a certain amount of automotive skill and knowledge. If you don't ask someone who does and read all you can on performance valve train systems for your engine to familiarize yourself with the subject.

Proper installation of Crower valve train components will require precise measuring, and in some cases precision machining. If you don't feel confident enough to do it yourself, by all means have a competent engine builder do it for you. You may find it well worth the nominal money spent to have the job performed correctly.

ATTENTION :

In the following pages, checking for proper clearances, possible component interface, and proper valve train geometry is called for. A temporary assembly for the complete valve train on the engine may be required.

It is your responsibility to make sure all clearances, measurements and machining is correct, regardless of whether you or an engine builder performs the work. It's smart to double check.

If you have any problems or questions, please give our technical assistance staff a call. One of our technicians can surely get you dialed in.
619.661.6477

Important CROWER Cam & Lifter Information

THIRTY MINUTES after an engine with a new camshaft is started for the first time, the initial stages of cam lobe failure may have begun! And no corrective action will prevent the process from continuing until one or more lobes are damaged so extensively that the engine will not operate properly. This doesn't mean that camshafts are delicate. But camshafts, like any other precision parts, must be treated with respect. A camshaft in a V-8 engine turning 6000 revolutions per minute is subjected to 800 high load impulses every second. Modern camshaft and lifter design, plus efficient lubrication systems, enable the camshaft to stand up under this load. But if the camshaft lobe-to-lifter-face relationship is altered, or lubrication is inadequate, camshaft failure is probable.

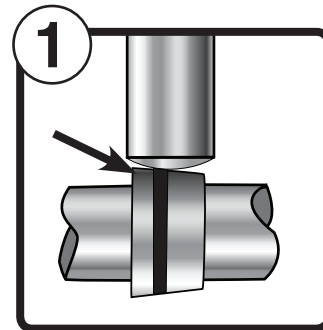
WHERE LOBE MEETS LIFTER

The camshaft lobe-to-lifter-face relationship is an interesting subject. From all appearances, the cam lobes are straight across, but actually, on all except a very a very few engines, cam lobes are tapered. The lobe taper may be from .0007" to .002" across the face. The lifter faces are also shaped differently then they appear. They are ground spherically with a .002" crown in the center. When the camshaft is in place and the lifters installed, the lifters are offset slightly from the cam lobes (Figure 1) Note:

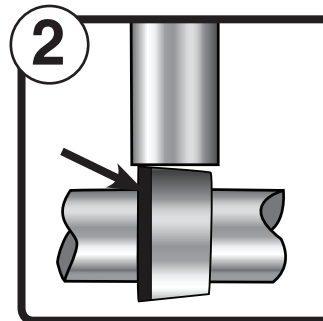
The illustrations dealing with cam lobe taper and lifter face curvature have been greatly exaggerated to better show the relationship between the lobe and lifter. The offset between the lobes and lifters aids lifter rotation and distributes valve spring loading over a wide area of the lobes and lifters assuring longer life. But most important, this off-set design, combined with tapered lobes and spherical lifter faces, is a specific cure for the greatest cause of cam lobe failure-edge loading. (Figure 2)

CAMSHAFT LOBE EDGE LOADING

A camshaft cannot withstand the load it receives if the force is concentrated on the edges of the lobes. The lobes will first chip and gall. Soon one or more lobes will be completely wiped out. This destruction can occur very rapidly. Wiped out lobes, accompanied by cupped lifters, are usually discovered due to noise or rough engine operation. When a worn lobe is found on a camshaft, the first reaction is to say it was "too soft". But cast iron camshafts are hardened as a unit, so one lobe can't be softer than another. If the lobes nearby are examined, they will probably be worn on the edges. The rest of the lobes would have eventually failed, but one went first and tipped off the operator that something was wrong.



1. The illustration shows the correct lifter-to-cam lobe contact.



2. Worn lifter has no crown, does not rotate and causes lobe edge loading.

NEW CAMSHAFTS NEED NEW LIFTERS

The biggest cause of edge contact on cam lobes is installing worn lifters with a new camshaft. Even if the lifters look OK, the spherical shape may be worn flat. If so, the lifters' with a new camshaft will result in will result in improper contact and early lifter and cam lobe failure. To avoid edge contact always install new lifters and a new camshaft together!

INITIAL LUBRICATION IMPORTANT

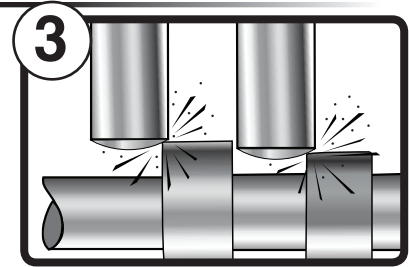
As has already been said, the first few minutes of engine operation can determine whether or not a camshaft will last. But even the first few seconds can be critical if the camshaft doesn't receive proper lubrication immediately. An oil film is necessary to prevent metal-to-metal contact between the lobes and lifters. If no oil film is present between the parts during the first few camshaft revolutions, the lobes and lifters may be seriously damaged. To be sure the camshaft will be protected when the engine is first started, the entire lubrication system should be primed before starting the engine.

QUALITY OF OIL IMPORTANT TOO

Most modern oils can withstand the high pressure between the cam lobes and lifters. They have an EP (extreme pressure) additive that increases the film strength of the oil to reduce the possibility of metal-to-metal contact between the lobes and lifters. But be sure to always use engine oil of at least an MS classification. Straight mineral oil should never be used because it doesn't have these EP additives to prevent metal-to-metal contact.

INCIDENTALLY

Early camshaft failure also can result from incorrect installation. Some V-8 engines use a bolt to hold the timing sprockets, thrust plate or washer and other parts in place. If these parts are assembled in the wrong order, or if the bolt is not tightened sufficiently, it may loosen and allow the camshaft to move far enough toward the rear of the engine that the cam lobes will collide with adjacent lifters. This is evidenced by lobe and/or lobe edge chipping. (Figure 3)



1. Camshaft free to move in engine block, lets lobes contact adjacent lifters and causes failure.

THE MOST CRITICAL 30 MINUTES

The most critical 30 minutes in a camshaft's life are the first 30 minutes. To help a camshaft get through these minutes, always follow these rules.

1. Always install new lifters and new camshaft together.
2. Insure adequate initial lubrication with oil of the proper additive level.
3. Always check for spring coil bind and retainer to guide clearance level.
4. Fast idle engine for first 30 minutes of operation.

LUBRICATION

Zinc and phosphorus have historically been the key ingredients for break-in and overall camshaftlife. ZDDPlus™ (Crower Part # 86092) is recommended for the installation process due to its high concentration of those anti-wear protective properties. (Not applicable for roller cams).

Inadequate lubrication during initial break-in is the #1 cause of premature cam lobe and lifter failure. Proper pre fire-up lubrication of your new Crower camshaft and lifters is necessary to insure fast break-in and long, trouble free life.

BE AWARE! Flat tappet camshaft failure is a major problem for the fact that your favorite brand of engine oil is not how it used to be. Due to environmental regulations, anti wear ingredients such as zinc and phosphorus have been dramatically reduced, which are the key ingredients for break-in and overall camshaft life. ZDDPlus™ (Crower Part Number 86092) is highly recommended due to it's high concentration of zinc and phosphorous which helps with this specific problem. ZDDPlus™ contains 42,700 ppm of phosphorus and 57,300 ppm of zinc. When a 4-ounce bottle of ZDDPlus™ is added to 5 quarts of oil, it is diluted 41:1, which contributes 1047 ppm of phosphorus and 1397ppm of zinc to whatever the oil may or may not already contain.

Step 1

Liberaly coat cam lobes, distributor gear, and lifters with the Crower Camshaft & Lifter Assembly Pre lube (#86073) supplied with each new Crower Camshaft.

Step 2

After installing cam and lifters in block, pour a 4 oz.. additive of ZDDPlus™ (Crower Part Number 86092) over the cam and lifters. Make sure plenty of ZDDPlus™ oil additive covers the lifter bores, lifter faces, and cam lobes. ZDDPlus™ adds much more real ZDDP than other product due to its extremely high concentration.

Using ZDDPlus™ eliminated large amounts of unwanted filler oil that less concentrated products contain.

Step 3

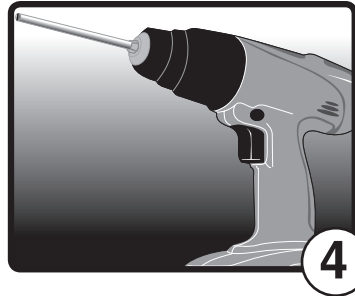
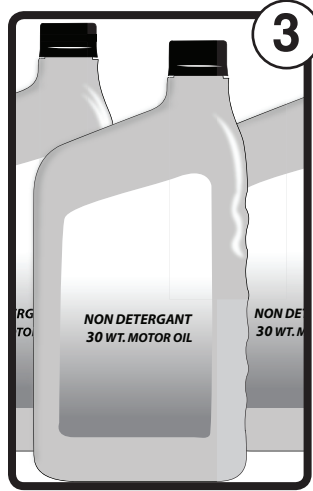
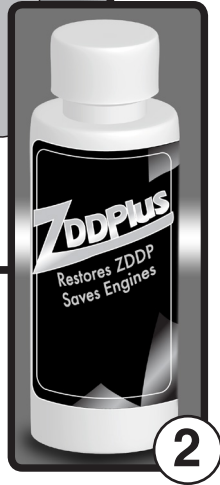
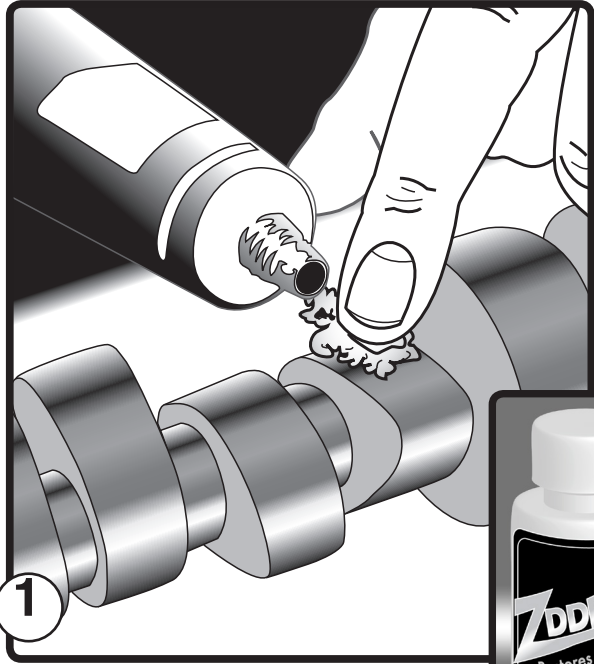
Top off your crankcase with a Non Detergent / race only petroleum-based 30wt. motor oil. Do Not use multi-viscosity (10-40wt. or 20-50wt., etc. due to the fact that it contains detergent) or synthetic oil for initial break-in.

Shearing of the oil film can occur resulting in destructive metal to metal contact. Multi-viscosity oil is fine after initial break-in is completed. Remember engine oil alone is not adequate for proper cam/lift break-in.

Step 4

Always prime the engine oil galley system before initial start-up. Most folks use an electric drill motor equipped with a special long, homemade, oil pump shaft . When the engine is properly primed you'll see oil spewing from the push rod ends at the rocker arm push rod seats.

Do Not try to pre-lube your engine by cranking the engine over with the starter motor. This “dry cranking” will scrub off the pre-lubricants and result in highly destructive metal to metal contact in your engine.



1. *Liberaly coat cam lobes and lifter faces with Crower Assembly Grease.*
2. *Pour a 4 oz. additive of ZDDPlus over the cam and lifters after installation in motor.*
3. *Coat the cam bearing journals with NON DETERGENT OR RACE ONLY SAE 30 wt. Motor oil.*

NOTE: *We do not recommend the use of multi-viscosity or synthetic oils with our cam and lifter packages during break-in due to the fact that it contains detergent.*

4. *Homemade long oil pump shaft and electric drill motor used for priming oil galley system.*

Installing a hydraulic camshaft when there is no provision for valve adjustment (such as adjustable rockers or push rods) requires special attention to several measurements and clearances to avoid noisy lifters or breakage.

There must be a clearance of .020" to .050" between the retaining snap ring and the top of the lifter push rod seat when hydraulic lifter is on the cam base circle. If the clearance is not correct, steps should be taken to remedy the situation.

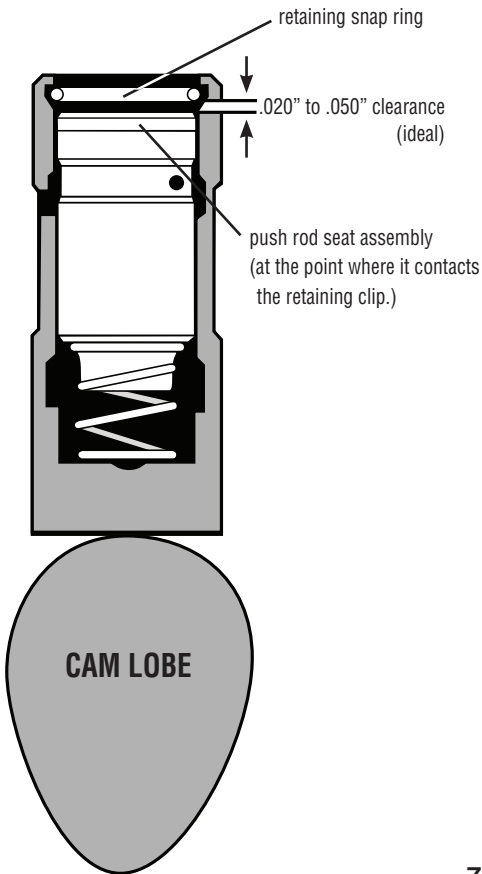
Incorrect clearance in the hydraulic lifter can occur if the following elements deviate from stock measures. Look for changes in:

1. Cam base circle diameter (smaller or larger).
2. Lifter height due to different manufacturer.
3. Push rod length.
4. Head gasket thickness.
5. Heads due to resurfacing, milling or several valve jobs.
6. Valve stem due to facing of end.

REMEDIES

1. Install different length push rods that allow proper clearance.
2. Install adjustable push rods.
3. Install adjustable rocker arms.

Our in-house push rod facility can make push rods of any size for any application. We also have push rod kits available. Each kit includes 16 non-adjustable push rods (1/4" longer than stock) with one end out, the 16 ends, and one adjustable push rod. You adjust the adjustable push rod to determine the correct valve train geometry and then cut the non-adjustable to length and press in the ends. If you are having problems with your installation or have questions, be sure to call our technical assistance staff or personalized professional recommendations.



Valve Springs: What you should know about them

Valve springs are a most important part of you valve train operation. Valve springs are responsible for properly controlling and seating the valves at varying RPM's and operation conditions. Proper installation of the recommended Crower valve springs is critical to achieving optimum performance and trouble free operation.

STOCK SPRINGS

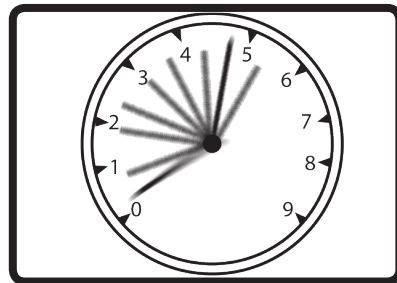
In most cases stock valve springs do a good job for stock camshafts. When changing to a high lift Crower performance camshaft, stock springs physically won't travel the distance your Crower high lift camshaft requires. The spring coils stack solid and the destructive condition called COIL BIND exists. Because the spring acts like a solid piece of metal in this condition, broken rocker arms, bent push rods, and worn lifters and camshaft can result.

Crower performance camshafts also deliver increased RPM capability. As RPM's increase, more valve spring pressure is required to control the reciprocating valve train mass as it opens and closes the valves (as RPM increase, valve train increase, similar to trying to hold onto a merry-go-round as it turns faster.) As stock springs reach their performance threshold, the condition called valve float occurs. The valve springs can no longer exert

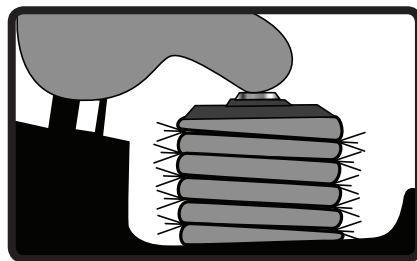
enough pressure to keep the lifters in contact with the camshaft lobes, and an out-of-control situation results. Valves begin bouncing off the valve seats, lifters slap precision cam lobes with devastating impacts, and pistons slam into valves that should be seated, etc. Massive and costly damage can result.

HIGH PERFORMANCE VALVE SPRINGS

Crower valve springs in many cases resemble stock spring but have subtle changes in material, wire diameter, outside diameter, inside diameter, and coil count. Our engineers have taken extreme care to properly match spring travel and pressure to accommodate your camshaft action and lift. In order to avoid coil bind, valve float and extreme damage to your valve train, always install the recommended Crower engineered valve spring kit with your new Crower performance camshaft.



1. Stock springs can loose control of valves when hi-revving performance cam is installed.



2. Stock springs can coil bind when used with high lift performance cams.

A SIMPLE CHECK

At full valve lift, your valve springs should have, at the very least, .050" of clearance between the coil. The outer spring, inner spring, and damper spring should all be checked for proper clearance. This is simply accomplished by slipping .050" feeler gauge between the coils with the valve fully open.

ACHIEVING CORRECT INSTALLED HEIGHT (pic. 1)

Each set of Crower valve springs comes with an installation card that specifies the correct installed height for your springs. Installed height is the distance from the spring seat on the cylinder head to the outside spring land on the bottom of the valve spring retainer (this is the space the valve spring occupies). Achieving the recommended installed height is imperative if the springs are to exert the pressures they were designed to deliver and properly control the valves.

If the springs install too high, Crower has shims available to close the space up. Or you can install one of Crower's negative offset (domed) spring retainer sets that produce the same results. (pic. 2)

If the springs install too short, you can:

- a. Machine the cylinder head spring seat deeper (.050" to .075" max) with the appropriate Crower spring seat cutter.

or... b. Install a set of Crower positive offset spring retainer set.

or... c. Install a new set of .100" longer stemmed valves to correct the problem.

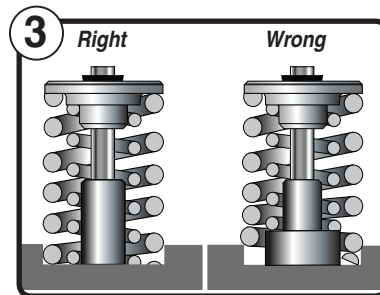
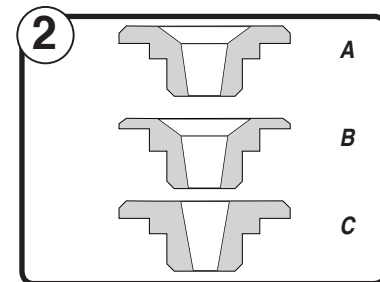
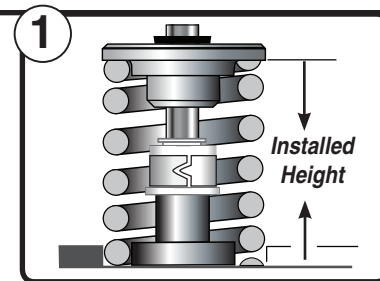
NOTE: If you don't find a retainer that corrects your problem listed in our catalog, our custom retainer service can make you a special set that will do the trick.

PROPER SPRING SEATING (pic. 3)

In some cases Crower performance valve springs do not seat properly on the stock spring seats. That is, they don't seat flush/square on your cylinder heads. This is especially true when going from stock single springs to high performance dual or triple spring designs. The usual problem is the spring O.D. is too large for the spring seat O.D. and/or the inner spring I.D. is too small for the stock valve guide O.D. Crower has available many compatible spring seat/valve guide cutters to facilitate machining of your cylinder head spring seats for proper spring installation.

VALVE STEM OIL SEAL TO SPRING CLEARANCE

When switching from single springs it will be necessary to install smaller diameter Crower positive sealing valve stem oil seals for proper seal-to-spring clearance. Crower has the valve guide machining tools for installing these superior seals.

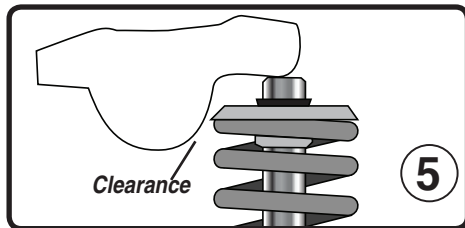
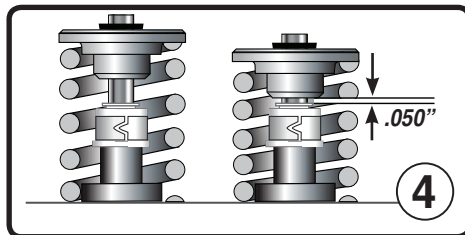


VALVE STEM OIL SEAL TO SPRING RETAINER CLEARANCE

Be sure the spring retainer is not contacting the valve stem oil seal when the valve is fully open. If there is contact, you'll need to machine the valve guide to get a 1/16" clearance. Crower has the proper cutting tools to perform this procedure.

ROCKER ARM TO SPRING RETAINER CLEARANCE

Installing larger than stock diameter valve springs can cause clearance problems at the rocker arm and valve spring retainer. Be sure to check for daylight between the retainer edge and the rocker arm nose. It is wise to recheck the clearance after break-in when new valve spring retainers have been installed. New valve spring retainers may settle a bit during break-in. Crower manufactures rollerized stainless steel rocker arms that provide adequate clearance for most all large diameter valve spring/high valve lift applications.



1. Correct installed spring height is a must for proper performance and longevity.
2. a. Standard retainer (0 offset).
b. Deep dish retainer (positive offset).
c. Domed retainer (negative offset) can help you achieve correct installed spring height.
3. Make sure your valve springs seat correctly on the cylinder head. Machining may be necessary.
4. .050" minimum clearance is required between retainer and oil seal at full valve lift. More clearance is fine.
5. Make sure the rocker arm is not contacting the spring or retainer at any point in its travel.

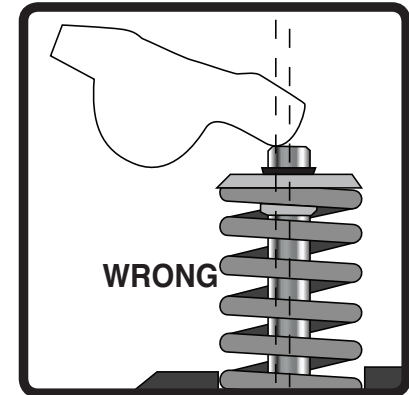
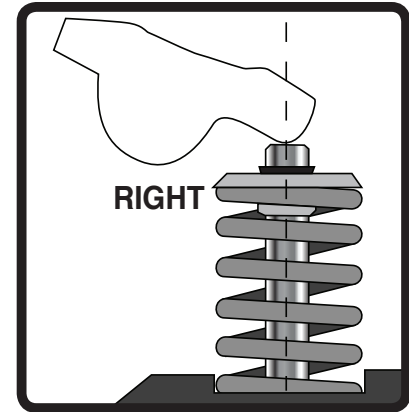
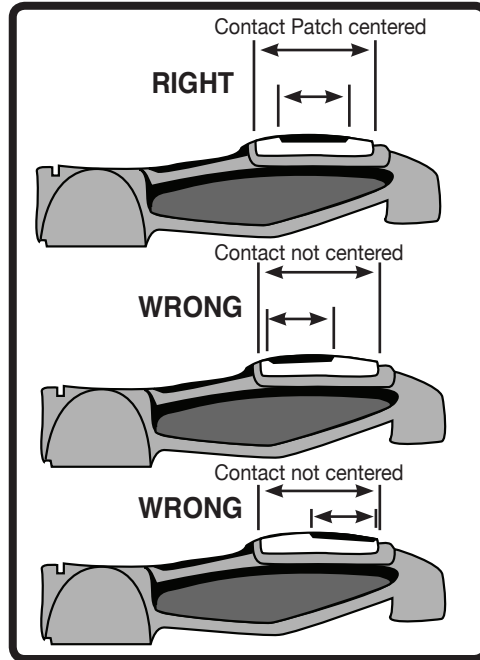
Proper Valve Train Geometry

When valve train geometry is incorrect, excessive side loading of the valve stem occurs. The valve tries to move sideways instead of up and down. The uneven loading causes premature valve guide wear and valve stem failure, decreases valve lift and kills power potential. Proper valve train geometry is based on the following relationships:

In OHV push rods engines, the rocker arm contact tip should be on the center line of the valve stem at half net lift. To correct improper rocker geometry in your engine, you'll need to replace your push rods with proper length push rods that correct the bad geometry. Crower has adjustable checking push rods available for determining the length you require. Call us with your stock push rod length (both intake and exhaust if they are different lengths). We can then custom make you an adjustable checking push rods with .500" (1/2") travel to make your job easier and more accurate.

In OHC engines, the camshaft contact patch should be centered-up on the rocker arm or contact pad (depending on the design of your engine). To check contact area, spray Dykem blue or Prussian blue on each rocker arm or contact pad where it meets the camshaft lobes. With valve lash properly adjusted, rotate the camshaft a couple of revolutions and inspect. If your contact patch is not centered, you can correct the problem by replacing your lash caps or contact

pads with thicker or thinner items that center-up the contact patch. A variety of lash cap and contact pad thicknesses are available from many manufactures and OEM dealer outlets.



Proper Valve Train Geometry: *continued*

THINGS THAT CAN THROW OFF VALVE TRAIN GEOMETRY

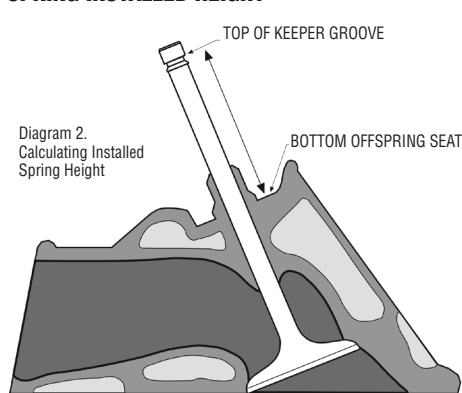
1. Installing a high lift/small base circle camshaft.
2. Milling the cylinder heads and/or engine block.
3. Installing different thickness head gaskets.
4. Surfacing the valve stem ends or installing longer-than-stock valves.
5. Deep seated valves from numerous valve jobs
6. Installing replacement rocker arm studs that vary from stock dimensions.
7. Installing lifters with push rod seats different than stock.

If you've performed any or all of the above procedures, chances are you'll need to make adjustments to correct bad valve train geometry. Crower has a large selection of push rods listed in the Master Catalog. If you can't find what you need there, our custom push rod facility can make a set just the right length for your application. Call us 619.661.6477

SPRING & RETAINER BUILD SHEET

By filling out the bottom form, Crower could help you choose the right spring, retainer, & keeper kit.

SPRING INSTALLED HEIGHT



Measure the height from top of keeper groove to bottom of spring seat. Refer to the "height" column of your retainer and add or subtract the amount given from the original overall measurement.

Cam Type:

- Hydraulic
Hydraulic Roller
Solid Lifter
Roller

Spring Seat O.D. (outside diameter): _____

Spring Seat I.D. (inside diameter): _____

Valve Guide Boss O.D. (outside diameter): _____

Spring Seat to top of keeper groove: _____

Valves: Titanium OR Steel

Valve: Intake _____ Exhaust _____

Rocker Ratio: Intake _____ Exhaust _____

Lobe Lift: Intake _____ Exhaust _____

Valve Stem Size: Intake _____ Exhaust _____

Cam Spec:

Advertised Intake _____ Exhaust _____

+ .050 Intake _____ Exhaust _____

Camshaft Installation Checklist

1. Lack of proper lubrication causes metal to metal contact and failure. Follow our break-in lubrication instructions. See “Lubrication” section of this booklet.
2. Installation of used lifters with your new Crower camshaft will result in cam and lifter failure. Always install new lifters with your new camshaft.
3. Many Crower high lift performance camshafts require more clearance than stock valve train components provide. To avoid VALVE TRAIN BIND and extensive damage always install the recommended Crower engineered kit with you new cam and check for the following potential problems:
 - a. High lift cams require valve springs with adequate travel to accommodate the increased valve lift. Installation of incorrect valve springs or improper installation of the valve springs can result in COIL BIND causing extreme damage to your valve train. Always use the recommended Crower engineered kit and install springs according to the instructions. Before starting your engine, with the valves fully adjusted, be certain that the valves will move at least an additional .050” when valves are at full lift.

- b. Check spring retainer to valve guide (oil seal) clearance. A minimum of 1/16” clearance should be maintained at full lift.
- c. In Chevrolet and Pontiac type rockers, be sure the slot in the rocker arm stud. Check with a .050” diameter wire when the valves is at full lift. Grind slot with 3/8” diameter stone if necessary to increase clearance.
4. Proper spring pressure is imperative to long cam lobe life. Always use Crower engineered kit and install according to instructions. See “Spring” section of this booklet.
5. High lift cams can cause piston to valve contact resulting in bent valves, rocker arms, push rods, chewed up lifter faces and camshaft lobes. Check piston to valve relief using modeling clay. A minimum of .090” intake, .120” exhaust clearance is required. When in doubt, call our technical assistance staff.

PLEASE NOTE:

Damaged cams and components caused by any of the above are void from warranty.

6. New billet and reground cams merit special consideration when they are installed. One of

the most commonly overlooked things is “rocker arm geometry.” Bad rocker geometry may be corrected by the installation of adjustable push rods or special length non-adjustable push rods. (both types can be purchased in any length needed). Before starting your engine, be sure it will turn over freely as a double check against any valve train bind.

7. Do not idle engine under 2000 RPM for the first 30 minutes. Use only a high grade detergent oil, preferably racing oil, and add the 4 oz. of ZDDPlus™ oil additive (# 86092) to aid cam and lifter break-in for solid and hydraulic lifter installations.
8. If lifters are ever removed from engine, make sure they are reinstalled in the same tappet bore.
9. The best method of checking for proper clearance is to have the engine assembled with inner springs only and valves adjusted correctly and with a dial indicator placed on the valve retainer. When the engine is 10 to 15 degrees B.T.D.C., check exhaust valve clearance by fully opening the valve until it contacts the piston clearance. By rotating the engine 2 degrees at a time in both directions, you will also find the point of least clearance. Go through the same

Camshaft Installation Checklist: *continued*

procedure with the intake valve but start at 10 to 15 degrees A.T.D.C. In place of a dial indicator, a feeler gauge could be used by stacking the gauges to get a reading with the valve fully open, and subtracting the valve lash.

Often, additional valve to piston clearance may be obtained by advancing or retarding the cam. This will work only if you have more clearance on one valve than you need, and the other valve is too close.

For example: Intake has .150" clearance and exhaust has .080" clearance; by advancing the cam to obtain .090" intake clearance, you will then have .140" exhaust clearance. This will also tend to put more low-end horsepower in the engine. If this is undesirable, then notching the pistons is required. A rule of thumb is for one degree of crank advance or retard, valve to piston clearance will be changed approximately .010".

Valve adjustment procedure #1:

There are many ways to adjust the valve lash, but one requirement is necessary ____ the cam follower (lifter) must be on the true base circle of the cam, or 180 degrees from the point of full lift of the lobe. One method of doing this is to adjust the valves of one cylinder while the valves of the alternate cylinder in the firing order are at full lift.

Example: Adjust the intake of #1 cylinder while the intake of #6 cylinder (the alternate cylinder in the firing order) is at full lift. Next, adjust #8 intake (Chev., Chrysler, etc.) with #5 intake at full lift. Follow the firing order, and then do the exhaust valves using the same procedure.

VALVE ADJUSTMENT PROCEDURE:

6 int. full lift, set 1 int.	1 int. full lift, set 6 int.
5 int. full lift, set 8 int.	8 int. full lift, set 5 int.
7 int. full lift, set 4 int.	4 int. full lift, set 7 int.
2 int. full lift, set 3 int.	3 int. full lift, set 2 int.

USE SAME PROCEDURE FOR EXHAUST

Valve adjustment procedure #2:

Adjust intake rocker as the exhaust rocker of the same cylinder starts to open. Then adjust the exhaust rocker of the same cylinder as the intake starts to close. This will put you on the base circle of that cylinder.

SPECIAL BREAK-IN PROCEDURE FOR HIGH LIFT CAMS

Applies only to cast flat tappet and hydraulic camshafts using dual springs.

Because many of today's high lift cam profiles require very high spring pressures for ultimate performance, great care should be taken in how the cam is installed and run. In the instance that you are using one of these profiles, we suggest that you use the following installation procedure:

1. Install only outer springs at recommended height.
2. Run engine at not less than 2000 r.p.m. for the first 45 minutes. This will assist in proper mating of cam lobes to lifters.
3. Install inner spring and readjust valves.

Note: If the lifters are ever removed from the cam for any reason be sure to mark them and replace back on same lobes. New lifters can be used on your cam at any time provided the lobes are in good condition.

Degreeing your Camshaft for Maximum Performance

For maximum performance, each Crower camshaft is carefully designed to open and close the valves precisely, in relation to crankshaft rotation and piston position (this is called valve timing.) That's why it's so important to make sure your new Crower camshaft is opening and closing the valves as it was design to do.

It used to be you could install a new Crower camshaft on the stock timing marks and be within 1° + or - of our recommended valve timing figures. Stiffer pollution control standards changed all that as automobile manufacturers advanced or retarded valve timing over the years to clean up dirty emissions.

Nowadays, you can't rely on stock timing marks for proper installation of your new camshaft. You should degree your camshaft to verify valve timing figures listed on the timing tag supplied with your camshaft. In doing so, you'll achieve maximum performance, torque and satisfaction.

Crower has a complete Camshaft Degreeing Kit available (#87601) that contains all the components necessary for achieving correct valve timing when installing your crower camshaft. Use the degreeing kit and the following procedures and you'll be in business.



STEP 1 FINDING TOP DEAD CENTER (TDC)

- a. There are several way to find TDC; one of the easiest is the positive stop method. Mount the degree wheel on the forward end of the crankshaft. Install a stationary pointer on the block that will extend to the edge of the degree wheel so that the pointer indicates TDC with the number one piston at the top of the bore.
- b. Install a strap across the No. 1 cylinder with a bolt in the center, if needed, to act as a positive stop. A bolt with a nut on both sides of the strap works fine. Adjust the bolt so that piston travel is limited to approximately .250" from TDC. In some cases where the piston has a dome, the bolt won't be needed.

- c. Rotate the crank in direction of engine rotation until the piston lightly contacts stop. Record reading indicated on the degree wheel. Rotate the crank in the opposite direction until the piston contacts the stop again. Record this reading also. If your readings on both sides of TDC on the degree wheel were the same, then the degree wheel was exactly TDC. If your readings were not the same, then add the two numbers and divide by 2, reset the degree wheel to this number. Go through the above procedure until all readings on both sides of TDC on the degree wheel are the same. The pointer will then indicate true top dead center with the stop removed.

STEP 2 CHECKING CAM TIMING AT .050" CAM LIFT

- a. After TDC is found, then the actual checking of cam timing can begin. First a dial indicator with at least 1.00" travel is needed. Mount the dial indicator over the lifter, making sure it is parallel to the lifter travel in both planes.
- b. Rotate the crank until No. 1 intake lifter is on the base circle of the cam lobe. Preload the dial indicator to a reading of approximately .050". This will cause the indicator to more closely follow cam contour.

Continued on next page.... 15

- c. Rotate the crank while watching the dial indicator to find the maximum lift point of the cam lobe. Rotate the crank one revolution from the maximum lift point. This will put the lifter in the center of the base circle. Without changing the indicator preload, the dial indicator face can then be set to zero.
- d. Rotate the crankshaft in the running direction until the dial indicator reads .050". At this point, the degree wheel will show the number of degrees before top center (BTC;) record this reading. Continue to rotate the crankshaft through maximum lift point until the dial indicator again reads .050". At this point the degree wheel will be indicating degrees after bottom center (ABC;) record this reading.
- e. Remove the dial indicator and reinstall it over No. 1 exhaust lifter. Repeat Steps "c" and "d" as explained above. The first .050" lift reading will be degrees at BBC (before bottom center.) The second .050" lift reading will be degrees at ATC (after top center.)

STEP 3 COMPARING READINGS TO CAM SPECS

When comparing readings with published cam specs, it is not at all uncommon to find differences of several degrees. This is due to manufacturing tolerances in key and dowel pin locations of the cam and crank sprockets and the cam itself. It should be kept in mind that the readings taken at the degree wheel would be crankshaft degrees; camshaft degrees should be one-half this reading.

Duration is calculated by adding 180° to opening and closing readings.

Overlap is determined by adding intake open degrees BTC to exhaust closing degrees ATC.

If after checking, it is desired to change the cam timing, there are offset bushing and keys available from Crower or most speed shop made just for this purpose. Also available from Crower are timing sprockets with multiple keyways for adjusting cam timing.

CROWER IS YOUR HEADQUARTERS FOR:

- ***Full line of hydraulic, solid and roller lifter camshaft.***
- ***Complete valve train and accessories.***
- ***Forged and Billet Crowerods***
- ***Forged and Billet Crower Crankshafts***
- ***Drag Racing and Oval Track clutches***

CROWER

**Important:
Flat Tappet Camshaft & Lifter
Installation Information**



CLB0114

LIMITED WARRANTY

In order for your Crower
Camshaft to be covered by
our warranty provisions,
you must register it at
<http://www.crower.com> .

No Dealer has authorization
to warranty Crower products.

The full warranty policy is
also available on our website.

If you do not have internet
access, please call
(619) 661-6477
and we will be happy to
assist you.

STAPLE YOUR TIMING TAG HERE

CROWER

6180 Business Center Ct.
San Diego, CA 92154-5604

Phone#: 619.661.6477

Fax#: 619.661.6466

www.crower.com