Camshaft Specification Table

Part Number	12-211-2	
Engine	1955-1998 Chevrolet 262ci-400ci 8cyl.	
Grind Number	CS 270H-10	
Description		
	Intake	Exhaust
Valve Adjustment	0	0
Gross Valve Lift	0.47	0.47
Duration At 0.006 Tappet Lift	270	270
Valve Timing At 0.006		
	Open	Close
Intake	29	61
Exhaust	69	21
These Specs Are For The Cam Installed At 106 Intake CL		
	Intake	Exhaust
Duration At 0.05	224	224
Lobe Lift	0.313	0.313
Lobe Separation	110	
Recommended Valve Springs	**981-16**	

COMP CAMS CAMSHAFT INSTALLATION & DEGREEING INSTRUCTIONS

COMPETITION CAMS

Congratulations on your purchase of a new COMP Cams camshaft! It is a highly sophisticated high performance part and requires a little bit of "TLC" during installation and break-in.

This instruction sheet is broken down into several categories so it will be easier for you to use. Some of the topics may not apply but, all of the information will be very beneficial during the cam installation process. For step-by-step visual detail, we recommend watching our cam installation video, "The Proper Procedure to Install and Degree a Camshaft" (part # 190-1). If you have any questions or problems at any time during your installation, please do not hesitate to contact the toll free CAM HELP line at **1-800-999-0853** for 7 a.m. to 8 p.m. CST Monday through Friday.

IMPORTANT:

In order for your new COMP Cams camshaft to be covered under any warranty, you must use the recommended COMP Cams lifters and valve springs. Failure to install new COMP Cams lifters and valve springs with your new cam can cause the cam lobes to wear excessively and cause engine failure. If you have any questions about this application, please contact our technical department immediately.

INSTALLATION:

Step 1: Prepare a clean work area and assemble the tools needed for the camshaft installation. We suggest you acquire an automotive manual to help determine which items must be removed from the engine in order to expose the timing chain, lifters, and camshaft. A good, complete automotive manual will save you time and possibly frustration during the installation.


A

Step 2: Once the camshaft, lifters and timing chain are exposed, line up the timing marks on the timing gears by rotating the crankshaft (fig. A). This will position the #1 piston at Top Dead Center. Next remove the camshaft timing chain sprocket, the timing chain, and the camshaft retaining plate if equipped. Remove all lifters, and reinstall the cam sprocket to serve as a handle. Slowly and carefully "roll" the camshaft from the engine. Excessive force is not required. If the camshaft does not come out easily, **stop!** Look for obstructions such as a fuel pump rods, distributor gears, etc. **Do not force the camshaft**. Something is holding it in the block.

Step 3: Once the camshaft is removed, pull the bottom timing gear off the snout of the crankshaft. In many cases you will need a gear puller to remove the crankshaft sprocket. The bottom gear is usually an interference fit, which may make it difficult to remove without the proper tool. Be careful mot to damage the threads in the end of the crankshaft.

Step 4: Now is the time to inspect all of the old camshaft related components (timing chain set, distributor gear, etc.) for abnormal or excessive wear. For example, using a excessively worn distributor gear with a new camshaft could result in severe engine damage. It is critical that the old lifters be properly disposed of, and new lifters installed. Your camshaft warranty will be voided if old lifters are used.

Step 5: Remove your new COMP Cams camshaft from its packaging. Inspect all lobes and the gear, making sure the camshaft was not damaged in shipment. Next, compare the stamped numbers on the end of the cam with the spec card, making sure this is the correct cam. It is a good idea at this point to lightly wire brush the distributor gear with mineral spirits or an equivalent solvent. Remember, during the installation process, the cleaner you keep your new components, the better chance you have of avoiding failure during the break-in period. Using the COMP Cams Assembly Lube supplied with your cam, coat all lobes and distributor gear. It is important to coat the lobes completely, yet not excessively. This same rule applies to the applies to the distributor gear and the fuel pump lobe (fig. B). Coat the cam bearing journals with straight SAE 30 or 40 wt. oil. We do not recommend the use of synthetic oils with our cam and lifter packages during break-in.


B


C

Step 6: We recommend you install a new COMP Cams timing chain and gear set for two reasons. First, the old chain is likely to be stretched beyond its service limits. Second, your old timing set, as well as many new ones on the market, may be machined to retard the cam timing. Either of these conditions will detract from the performance your camshaft was designed to deliver. Temporally install the cam sprocket on the camshaft. The sprocket will again serve as a handle to help "roll" the cam into its bearing. Carefully slide the camshaft into the engine, oiling the bearing journals as it slides into the block (fig. C). Excessive force is not necessary to install the cam. Take your time. You do not want to scar the camshaft or the cam bearing. Be sure you do not wipe away any of the assembly lube as you install the cam into the block. Once the cam is installed in the block, fully remove the cam sprocket. If your engine was equipped with a camshaft retaining plate, it should be installed at this time. Refer to your engine manual for the proper torque specs for the retaining plate bolt.


D

Step 7: Install the new crankshaft sprocket on the snout of the crankshaft (fig. D). We recommend using a Crankshaft Timing Sprocket Installation Tool (Part #4933) for all applications having an interference fit crank sprocket. If you are installing either a solid roller or hydraulic roller cam in your engine, now is the time to check camshaft endplay. For instructions on how to do so, see "Checking Cam Endplay" on page 2. If you are installing a hydraulic or solid lifter cam (flat tappet cam) in your engine, this step is not necessary in the majority of engines. This is because the taper ground into the cam lobes of these type cams pushes the cam into the proper position and holds it there while the engine is running. Checking endplay is also unnecessary in engines equipped with cam retaining plates, whether the cam used is a flat tappet or a roller.

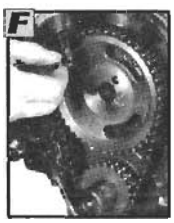
SHOULD YOU DEGREE YOUR NEW CAM?

It isn't absolutely necessary to degree the cam for the engine to run efficiently. We grind all of our High Energy and Magnum cams 4 degrees advanced. This positions the camshaft for the best street performance. However, to assure maximum performance we recommend you degree your new camshaft. The purpose of degreeing a camshaft is to correct the errors and tolerances in the machining processes of the engine that can affect camshaft timing. If you do decide to degree your new cam, we suggest the intake centerline method. It's simple, quick, and efficient!

Step 8: Reinstall the cam sprocket temporarily. Check the timing mark alignment in your engine manual. Rotate the crankshaft and camshaft to its proper position. Our small block Chevy has a "dot over dot" alignment as shown (fig. E). Remove the camshaft sprocket and install the new COMP Cams chain. Bolt the cam sprocket to the cam,

making sure the sprocket is pulled up flush onto the cam (fig. F). Once again, make sure the timing marks are positioned properly and according to your manual.

Refer to your manual for the proper torque specifications before tightening the camshaft bolts or bolts. We also suggest that Loctite® be applied to the threads of the camshaft bolts to assure the bolts remain torqued to the proper specification. **This process is very important!** Improperly torqued camshaft bolts can loosen and cause severe engine damage. A camshaft bolt locking plate is recommended for Chevy 262-400 c.i. and 396-454 c.i. engines. Ask for COMP Cams part # 4605.



Step 9: Remove your new COMP Cams lifters from the packaging and clean the lifters thoroughly in mineral spirits or an equivalent solvent. Remember, in order to protect your camshaft warranty, new lifters must be installed. It is not necessary to "pre-pump" hydraulic lifters full of engine oil prior to installation and valve adjustment. It is actually undesirable to do so as the "pumped up" lifters will cause the valves to open during the adjustment process, rather than positioning the valve lifter plunger in its operating position as it is supposed to do. "Pre-soaking" hydraulic lifters in a bath of engine oil is a good idea, but is not mandatory. It does ensure that the lifters are adequately lubricated on their outer surfaces prior to installation. It may also result in a quieter engine start up as the oil in the bath may displace some air from the lifter's plunger reservoir. Coat the bottom of all lifters with the COMP Cams' Cam Lube supplied with your cam (fig. G). Install the lifters, making sure they fit well and rotate freely. Any excess clearance or tight lifters can cause damage to the camshaft, leading to engine failure.

Step 10: Next, we recommend you install COMP Cams Magnum Rocker Arms and Pushrods. They ensure compatible mating surfaces and long life. Additionally, because of the increased stiffness, accuracy of ratios and roller tip, Magnum Roller Rockers can give you up to an extra 15 to 30 HP over stock or stamped rocker arms. Both the Magnum Rockers and COMP Cams Pushrods are conveniently packaged in the RP-KIT (fig. H). Clean all pushrods thoroughly because most engines oil through the center of them. If the original pushrods are being used, be especially sure they are clean inside and out. Apply a small amount of COMP Cams lube or equivalent lube on each end of the pushrod and install into the engine (fig. I). Clean all rocker arms thoroughly. If the original rocker arms are used, examine each one for excessive wear and replace any that are questionable. Apply a small amount of COMP Cams lube on all contact areas of the rocker arm. With a clean rag or towel, wipe the tips of the valves clean and apply COMP Cams lube on the tip of each valve where the rocker arm will come in contact with it. Also, be sure to check the valve tips for excessive wear.

Step 11: Install rocker arms (fig. J). Do not tighten the adjusting nut down before you go through the proper sequence. On engines with shaft mounted adjustable rocker arms, back off all adjusters completely before installing the assembly. Make sure the pushrod is in the lifter and the rocker arm seat when making valve adjustments.

For hydraulic lifter camshaft adjustment, turn the engine in the normal direction of rotation. When the exhaust valve begins to move, adjust the intake valve to zero lash plus an additional 1/2 turn more. Rotate the engine over again until the intake valve reaches maximum lift and is almost all the way back down. Set the exhaust valve to zero lash plus 1/2 turn. Adjust the valves on each cylinder in this manner until all valves are adjusted (fig. K). If your engine has nonadjustable rocker arms, a lifter pre-load of .020" to .040" must be maintained. **See "Nonadjustable Rocker Arms" for proper pre-load instructions.** For mechanical lifter camshafts, follow the same adjustment procedure. Instead of lifter pre-load, use the prescribed valve lash clearance found on the cam specification card. Mechanical valve lash adjustment is recommended at every oil change.

Step 12: It is very important to "fire" the engine as quickly as possible. The only lubrication that the camshaft receives is from oil slung off the crankshaft. First, change the oil and filter using as SE, SF grade or racing oil for initial break-in. Fill the new oil filter with oil before installing. This allows the engine to achieve oil pressure immediately. Timing the engine properly the first time will be necessary for the engine to start quickly. The following procedure is simple and effective. Rotate the crankshaft in normal crankshaft rotation until the number one cylinder is coming up on the compression stroke. Align the timing mark on the balancer/dampener to the recommended factory initial timing setting, making sure that both valves on the #1 cylinder are closed. Install the distributor with the rotor pointing to the #1 plug wire on the cap. The engine should fire up as soon as it receives fuel.

Step 13: Important! As soon as the engine fires, bring the engine RPM to 1500 to 2000 during the first 30 minutes of operation. Slower engine speeds may not supply the camshaft with an adequate amount of oil for the break-in period. Change RPM periodically to direct oil splash to different areas of the camshaft. After the 30 minute break-in period, change the oil and filter again to be sure all contaminants and break-in lube are removed from the engine. If the camshaft you are using required double valve springs, we recommend removing the inner spring for camshaft break-in.

If you do not understand any part of these instructions, please contact one of our CAM HELP technical consultants at **1-800-999-0853**. We'll be glad to help you with any problems or questions you may have.

CHECKING CAMSHAFT ENDPLAY

Camshaft endplay refers to how much a roller cam is allowed to move back and forth in the engine. Some endplay is required to eliminate the possibility of wear occurring as a result of interference between the cam and other engine components. Excessive endplay is detrimental as the cam will be misaligned to the lifter bores, causing the roller wheels on the lifters to run off the edge of the lobes instead of the center. If the endplay is too much, it can result in the lifter from one cylinder hitting the lobe adjacent to it. Needless to say, this is disastrous! Another important effect of camshaft endplay is that as the cam moves back and forth, it advances and retards the ignition timing at the distributor gear.

The proper amount of endplay is between .004" and .010." This can be check rather easily using a dial indicator and magnetic base on the front of the engine. Merely push the cam as far back in the engine as possible, zero the indicator on the upper timing gear and pull the cam as far forward as it will go. The indicator reading will tell you the endplay.

In Chevrolet engines, you have to have the front cover in place to check endplay since the cover is the forward stop for the roller cam

and timing gear combination. Also, you must have a cam button in place to take up the additional space between the gear and front cover. These are typically made of Teflon/fiber or steel. The steel buttons have a miniature roller bearing built in. All types are available for COMP Cams in various lengths, depending on the type of front cover you are using.

The front cover Chevrolets make using the dial indicator technique for endplay determination difficult. Some of the front covers have an access hole with a pipe plug in it to allow a dial indicator extension to go through the hole and contact the upper timing gear. The stamped front covers have no such provision. Therefore an alternate technique that can be used is to gently insert a long screwdriver in one of the lifter bores and carefully pry the cam back and forth using the sides of the lobe in the bore. Do not use excessive force to try and move the cam! Estimate from the lobe in its extreme positions on either side of the bore how much endplay exists, and adjust accordingly. If the endplay is too much, install some suitable shim material behind the cam button and recheck. If it is too small, carefully remove some material from the back of the cam button, reinstall it in the timing gear, and recheck.

One final note of warning, stamped steel Chevrolet front covers are typically very flexible where the cam buttons contacts them. This is detrimental to maintaining a consistent amount of endplay. Washers are available to weld inside the front covers to stiffen them. Also, the water pump fits tightly to some front covers and can act a support. But for most race type roller cam applications we strongly recommend the use of a cast or billet aluminum front cover such as COMP Cams part #210 to eliminate any front cover flex-induced changed in endplay.

SETTING SOLID LIFTER VALVE LASH

Consult the Cam Spec Card for the correct lash specification. All COMP Cams card are listed "hot" (operating temperature) but will work for initial start-up. By hand, rotate the crankshaft (in the running direction) until the exhaust pushrod begins to move upward, opening the valve. You can now adjust the intake lash by tightening the rocker nut while the proper thickness feeler gauge is inserted between the valve stem and the tip of the rocker. Tighten the rocker nut until there is a slight drag when moving the feeler gauge. To adjust the exhaust valve, rotate the crankshaft until the intake pushrod moves all the way up and goes past the "top" until it is one-half to two-thirds of the way back down. Adjust the exhaust rocker nut (with the proper feeler gauge) using the same procedure as with the intake rocker above. Repeat for all cylinders. (Note: you may find it easier to set and hold valve lash using COMP Cams polylocks)

After setting lash with the engine cold, start it up following the break-in procedure in step 13 above. After breaking-ion the camshaft, the engine will be at operating temperature. Due to thermal expansion, the lash will now be looser that it was when the engine was cold. Repeat the entire adjustment process above to ensure proper lash at operating temperature.

SETTING HYDRAULIC LIFTER PRE-LOAD

When installing a hydraulic cam, new hydraulic lifters or rocker arms, it is necessary to establish the proper lifter pre-load. Insufficient lifter pre-load will cause excessive valve train noise. Excessive lifter pre-load will cause the engine to idle rough or have low manifold vacuum and can lead to severe engine damage. Its critical to engine efficiency and to the service life of the valve train (camshaft, lifters, pushrods, valve springs, etc.) for the lifters to have the proper amount of lifter pre-load. On any hydraulic lifter camshaft, the ideal lifter pre-load should be .030." A variance of + or - .010" is acceptable.

ADJUSTABLE ROCKER ARMS

Install the pushrods into the engine. Install the rocker arms, balls and nuts on the rocker studs. Be sure the pushrods are seated properly

into the lifter and the rocker arm seats. Turn the engine over by hand in the direction of rotation until the exhaust pushrod just begins to move upward to open the valve. You are now ready to adjust the ***intake*** rocker of the same cylinder.

Carefully tighten the nut on the intake rocker arm while spinning the pushrod with your fingertips. You will feel a slight resistance in the pushrod when you have taken up all of the clearance. This is referred to as "zero lash." Now turn the adjusting nut 1/2 turn more. Generally, 1/2 turn on the adjusting nut will provide the suggested .030" pre-load.

Once again, turn the engine in its direction of running rotation until the intake pushrod comes all the way up and almost all the way back down. Now set the ***exhaust*** rocker to "zero lash" and add 1/2 turn (fig. M). You now have set the pre-load on one cylinder. Repeat these same steps to set the pre-load on each cylinder.

NONADJUSTABLE ROCKER ARMS

In situations where you are dealing with nonadjustable rocker arms. A different procedure must be followed. After applying lube, install the pushrods and torque all rocker arm bolts down in the proper sequence and torque specification. Rotate the engine by hand in the normal direction of engine rotation until both the exhaust and intake valves have opened and closed completely. Allow a couple of minutes for the lifter to bleed down.

Using the valve cover gasket surface on the head as a reference point, place a mark on the pushrod. It is advisable to use a pencil or scribe to mark the pushrod. The smaller and more defined the mark, the more accurate the measurement. Be sure the reference point you choose for the first mark is easily accessible and easy to duplicate. You will be marking the pushrod twice. It must be from the same reference point and angle for the measurement to be accurate.

Loosen the rocker or rocker shaft bolts. Leave the rockers on the head so that they will support the pushrods. Be sure the pushrods are standing free in the lifters, and do not have any pre-load. Using the same reference point, place a 2nd mark on the pushrod. Make sure the angle and reference point are the same as the first mark.

You now have 2 marks on the pushrod; one with the assembly bolted into place as the engine will run, and the 2nd mark with the lifter unloaded. The distance between these two points will represent the amount of lifter pre-load your engine has.

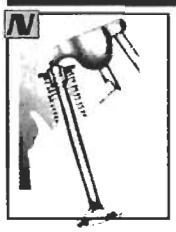
If you find that the pre-load is not within .020" to .040" range, adjustment will be necessary. The simplest way to accomplish this is by using different length pushrods. These pushrods are available for most with nonadjustable rockers. When measuring to find the correct length needed, be sure to included the .030" pre-load that the lifter requires.

If your engine has pedestal style (bolt mounted) rockers, you can use shims under the pedestal to lessen the pre-load. This method also works with shaft mounted rocker systems. Longer pushrods will be needed for insufficient pre-load.

In most cases, you will only need to check one intake and one exhaust pushrod; however, if your valve stem heights are not equal, you will need to check pre-load on each valve. If this procedure is not followed, it will almost certainly result in poor running engine and ultimately engine failure.

If you do end up needing Custom Length Pushrods, call CAM HELP at **1-800-999-0853**. We offer high-quality, two piece pushrods and, in most cases, we can send them out within 24 hours to minimize your engine down time.

ROCKER ARM CLEARANCE



Rocker arm clearance must be checked at several places. It is very common with higher lift cams to have the rocker arm contact the rocker stud when the valve is at full open position. Be certain to check this, as lack of proper clearance will cause broken studs, broken pushrods, or a worn-out camshaft.

The clearance between the rocker arm and the retainer must also be checked. This problem will be more pronounced when the valve is closed. The retainer is likely to contact the underside of the rocker arm right in the center. Be sure to maintain at least .030" clearance at this point (fig. N).

When assembling the head, check the retainer to valve seal clearance. Sometimes when you install a high lift cam and a different seal, this distance becomes too small. This will bind the valve train and result in camshaft failure. If the clearance does not measure the total valve lift plus .060" the heads should go to a machine shop and the guides shortened.

Pushrod clearance must also be checked, especially when using a higher-ratio rocker arms. The pushrod seat in the rocker is moved toward the stud in this case, so it must be checked at several different lift points.

VALVE SPRINGS

The number one factor in premature failure of a new camshaft is am improper or worn-out valve spring. Either incorrect pressure or incorrect spring application will lead to a worn-out cam. For this reason, it is highly recommended that the corresponding part number COMP Cams spring be used in any cam change.

Most aftermarket cams have much-higher-than-stock lift. Therefore the stock valve springs will "coil bind" or "stack" before the cam reaches its full lift This condition will cause the cam to fail immediately. You should always use the recommended part number spring with a new cam, and check to be sure there is no coil bind. With the valve at full lift, check the clearance between the coils. You need to maintain a minimum of .060" between the coils at this point. (fig. O).

Excessive spring pressures will also lead to early failure. These pressures can be the result of incorrect springs, short valves, improper retainers, or many other factors unrelated to the cam or the valve spring. The only way to ensure the correct pressure is to actually check the installed height and pressure. Refer to the instructions in the valve spring box or contact COMP Cams at **1-800-999-0853**.

Coil bind will not usually be a problem when High Energy Camshafts are used; however, the big block Chevy is an exception to this rule. When installing any non-stock cam, it's recommended to check for coil bind, but it's imperative that coil bind be checked on the higher lift and Magnum Series of camshafts. With the 292H or 305H Magnum Cams, the valve springs ***must*** be replaced, Stock valve springs will not have sufficient travel for cams that incorporate that much lift.

PISTON TO VALVE CLEARANCE

Anytime a higher-than-stock lift camshaft is installed, it is important to check piston to valve clearance. The High Energy Series and smaller Magnum cams, such as the 270H, 280H, 270S, or 282S camshafts, should not have this problem; however, the 292H, 294S, 280AR, and larger camshafts may have an interference problem.

COMP Cams strongly urges you to check the piston to valve clearance on the larger street cams, and on all race cams. We recommend at least .100" clearance on the intake valve and at least .125" for exhaust valves. If aluminum correcting rods are used, add a minimum of .030" to the suggested clearance figures. Aluminum rods will stretch and expand more than a steel rod.

The easiest and possibly most accurate way to check piston to valve clearance is to place strips of modeling clay on top of one pistons, then rotate the engine over by hand with the head bolted in place and all of the valve train with valves adjusted. The resistance in turning, stop! The piston has probably hit the valve.

A decision must be made to flycut the piston, which will involve completely disassembling the engine, or to exchange the cam for a profile that will fit into your engine. Do not try to operate the engine with less than .100" clearance on the intake and .125" on the exhaust. Costly engine damage will occur.

CHECKING PISTON-VALVE CLEARANCE

Step 1: With the camshaft installed, remove the cylinder head from the block. Clean the combustion chamber and the top of the piston and valve reliefs. The cleaner the piston, the better the clay will stick to it.

Step 2: Apply a strip a model clay 3/8" to 1/2" wide a approximately 1/4" thick to the pistons. The clay strips should be placed perpendicular (across) the intake and exhaust valve reliefs (fig. P). Applying a small amount of oil to the clay will prevent it from sticking to the valves as they press into the clay.

Step 3: Reinstall the cylinder head with the gasket that is going to be used. It will not be necessary to re-torque the head yet. All head gasket manufacturers can tell you what the compressed thickness of their will be. Measure the gasket before you install it permanently and add the difference of the gasket thickness to your piston to valve clearance. This will be within .001" or .002" of the exact clearance.

Install a sufficient number of head bolts to secure head in place while you are rotating the engine. Install the pushrods, lifters and rocker arms on the cylinder you have prepared for the clearance check.

Step 4: Adjust the rocker arms to their suggested clearance. If the camshaft you are checking uses the hydraulic lifters, you must temporarily use solid lifters in their place. Hydraulic lifters bleed down and would provide a false measurement. Once the hydraulic lifters are replaced with solid lifters, adjust the lash to "zero." Be sure not to pre-load the valve spring (fig. Q). Be sure to reinstall the hydraulic lifters before starting the engine.

Step 5: Now turn the engine over by hand in the normal direction of rotation. Be sure to rotate the engine over 2 times. This will be one complete revolution of the cam and assure you of an accurate reading on both the intake and exhaust. Remove the cylinder head from the block. Be sure to do this gently, so the clay is not disturbed. It may be stuck to the valves or combustion chamber, so be careful.

Step 6: With a razor or a sharp knife, slice the clay cleanly, lengthwise through the depression and peel half of it off the piston (fig. R). The clay's thickness in the thinnest area will represent the minimum piston to valve clearance.

Step 7: To accurately check the thickness, use a set of dial calipers (fig. S). The clay can also be measured close enough with a thin steel rule.

NOTE: Be sure to check piston to valve clearance *after* the cam has been degreed in. The positioning of the cam in the engine will greatly affect the piston to valve clearance.

CAMSHAFT DEGREEING INSTRUCTIONS

The purpose of degreeing a camshaft is to ensure that it is phased correctly with the crankshaft. Some factors that may cause improper positioning are:

1. Cam or crank gear marked incorrectly.
2. Incorrectly machined cam or crank gear keyways.
3. Misindexed cam keyway or dowel pin.
4. Improper machining of camshaft or crankshaft.
5. Accumulation of machine tolerances

The important factor to remember is that camshaft position or phasing to the engine is extremely important for the engine to operate at maximum efficiency.

Equipment needed to properly "degree" in a camshaft. They are available at COMP Cams and are as follows:

1. Degree Wheel
2. A rigid pointer that cam be attached to the block.
3. A dial indicator to accurately measure cam lift.

Note: Refer to your spec card for maximum lift and check your dial indicator to be sure it has sufficient range to measure the full cam lift.

4. Either a magnetic or attachable base to affix the dial indicator.
5. A Top Dead Center stop.
6. A solid lifter to fit your engine. Engines that have nonadjustable rocker arms will also require an adjustable pushrod that accommodates that engine.
7. A means to attach the degree wheel to the crankshaft.

A" Cam Degreeing Kit" is available, COMP Cams part # 4796 (fig. A)

THE INTAKE CENTERLINE METHOD

There are several accepted ways to degree a camshaft. At COMP Cams, we feel the Intake Centerline Method is the easiest and most accurate. This method of cam degreeing is very practical and indifferent to design characteristics. It simply involves positioning the center, or point of maximum lift, of the #1 intake lobe with top Dead Center of the #1 piston. The Intake Centerline Method still requires accuracy to be correct, but it is somewhat more forgiving. Once you have degreed a camshaft using this method, you will be surprised at its ease. We also recommend positioning the dial indicator on the #1 intake retainer because lift measurements will include any deflection that may occur in the pushrod and rocker arm. This makes the degreeing process as accurate as possible in relation to what actually goes on inside the engine.

TIME TO GO TO WORK

Step 1: The camshaft and timing set have been installed. Make sure that the timing marks on both the cam gear and crank gear are aligned properly per the cam installation instructions. Use chalk or similar marker to better define the marks.

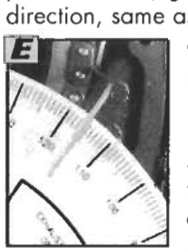
Step 2: For example, we have our cam card and it suggests we install the cam on 106 degree intake centerline. Install all the rocker arms and pushrods in the engine as normal. On #1 intake lobe, install the solid lifter in place of the hydraulic lifter. If a solid lifter or roller can is being checked, use that respective
lifter. Adjust the #1 intake lash to exactly zero. Do not pre-load the lifter. Next, adjust the #1 exhaust lash to zero. You should be able to turn both pushrods with your fingers easily.

Step 3: Attach the pointer to the block. Many people will make a pointer out of some sort of rigid, yet manageable wire. A stiff coat hanger wire works well (fig. B).

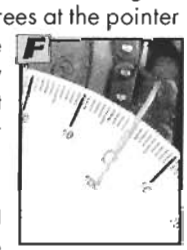
Step 4: Attach the degree wheel to the balancer and install the assembly on the crankshaft. There are several ways to attach the degree wheel to the crankshaft. In our example, the degree wheel is mounted to the balancer. The crank may be rotated from either the front or from the flywheel end. Obviously, if the engine is in the car, you must rotate from the front. Remember, the greater the leverage, the smoother the crank rotation, thus more accuracy. **NEVER** use the starter to turn the engine while degreeing the cam.

Step 5: Before installing the piston stop, rotate the crankshaft to get the #1 piston in approximate T.D.C. position with both the intake and exhaust valves closed. This can be a rough guess, but it can save you from making a mistake later. Adjust your pointer to zero or T.D.C. on the degree wheel.

Step 6: Turn the crankshaft opposite the engine rotation approximately 15-20 degrees. This will lower the position enough to allow the T.D.C. stop to be installed in the spark plug hole. Screw in the piston stop until it touches the piston. (fig. C). Continue to turn the engine in the same direction until the piston comes back up and touches the piston stop. Mark the degree wheel with a pen or pencil on the number the pointer is on (fig. D). turn the engine in the other direction, same as engine rotation, until the piston comes back up and touches the piston stop. Make a mark on the number the pointer is on (fig. E).



Step 7: Remove the piston stop after marking the two points on your degree wheel. Rotate the crankshaft to the midpoint of the two marks. This point is T.D.C. for cylinder #1. Without rotating the crankshaft, adjust the degree wheel to read 0 degrees at the pointer (fig. F). You are now ready to locate the intake lobe centerline relative to T.D.C. If you are not absolutely sure that you 0 degree mark is set at T.D.C., repeat this procedure. This step by step is critical to proper cam alignment.



Step 8: Attach the dial indicator to the dial indicator mount. Position the dial indicator mount so the tip will contact the retainer of the intake valve (fig. G). It is important that the indicator plunger be parallel to the valve stem. Any variance in the angle of the indicator will introduce geometric errors into the lift readings.

Step 9: Rotate the engine in the normal direction of crankshaft rotation until you reach maximum lift. The dial indicator will change direction at the point of maximum lift. At this point, set the dial to zero (fig. H).

Step 10: back the engine up (opposite normal rotation) until the indicator reads .100." Turn the engine back in the normal direction of rotation until the dial indicator reads .050" before maximum lift. Record the degree wheel reading.

Step 11: Continue to rotate the engine over in its normal direction of rotation until the indicator goes

past zero to .050" on the closing side of maximum lift. Again, record the degree wheel reading.

Step 12: Add the 2 numbers together and divide by 2. That number will be the location of maximum lift of the intake lobe in relation to at the crank and piston. This is the intake centerline. For example: The first degree wheel reading was 96 degrees. The second reading was 116 degrees. These 2 numbers (96 +116) added together will be 212. 212 divided by 2 will equal 106. Your actual intake centerline is 106 degrees. Reference back to your cam spec card and we see that the recommended intake centerline for your camshaft is 106 degrees. Everything is where it should be.

In the event that your camshaft did not degree in as per manufacturers' specs, it will be necessary to either advance (move the cam ahead) or retard (move the cam back) the cam to meet suggested intake centerline. Depending on the engine application, there are several different suggested methods for advancing or retarding the camshaft.

One common method is by use of a crank gear with multiple keyways-each one being at a slightly different relationship to the gear teeth. A 2nd method is to use offset bushings that fit on the cam pin and in the cam gear. The offset will advance or retard the cam depending on how the bushing is placed on the cam pin. Another method is by offset keys that fit into the crank gear keyway. A more elaborate system uses an adjustable timing gear. Contact COMP Cams or your local COMP Cams dealer for the method best suited to your application.

NOTE: When degreeing a cam, remember to look at the degree wheel as a full 360 degrees no matter how the degree wheel you're using is marked. Many degree wheels are marked in 90 degree or 180 degree increments. On wheels that are marked in 90 degree increments, keep in mind that you must continue to count the number of degrees on past 90 degrees. Be sure all readings are taken from Top Dead Center.

Keep in mind that to advance the cam, you must lower the intake centerline. For example, if our cam has a lobe separation of 110 degrees, the cam is "straight up" when the intake centerline is 110 degrees. Moving the centerline to 106 degrees advances the can 4 degrees. If we change the centerline to 112 degrees, this would be 2 degrees retarded.

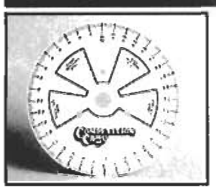
We at COMP Cams hope that these instructions will be helpful in making your camshaft installation and degreeing a successful experience. COMP Cams produced a video entitled "The Proper Procedure to Install and Degree a Camshaft" (fig. I). This video covers all of the points discussed here and illustrates many other helpful tips to achieve the maximum performance from your engine. If you wish to order this video, or if you have any other questions concerning your cam change, please call our CAM HELP technical line at 1-800-999-0853. Our technical specialists are here to help you 7 AM to 8 PM (CST) Monday through Friday.

To Prevent Broken or Damaged Valve Train Components, Please read and Follow These Instructions Completely

- The number one cause of mechanical and hydraulic camshaft failure is worn or incorrect valve springs which results in premature wear of camshaft lobes and lifters
- Competition Cams strongly reccomends replacing valves springs on any engine with 60,000 miles or more. Stock (O. E. M.) springs may be retained in some applications where a small cam is used such as a 252H or 260H.
- For most engines using a 268H or larger cam you **must** change valve springs and if necessary, remove the exhuast valve rotators to acheive the correct installed height and spring pressure.
- If you do not use enough seat pressure, valve float will occur causing damage to springs, locks, retainers, valve stem and groove, valve job, pushrods, rocker arms, cams, lifters and the engine will not RPM high enough. If the open spring pressure is excessive, worn lobes will be the result. Please refer to your camshaft spec card or Competition Cams' Valve Train Reference Catalog to determine the valve spring needed for your application.
- During the camshaft break-in cycle, remove the inner springs to help prevent premature lobe wear. Run the engine 2000 RPM for 30 minutes.
- Competition Cams strongly recommends to always install a new distributor gear. Remember to lube gear generously with Competition Cams' Cam Lube or other suitable lubrication each time a new cam is installed to prevent premature gear wear.
- Always use plenty of cam lube on the lobes.
- Always pre-adjust lifters before startup and break-in to allow for proper lifter rotation.
- Stock rocker arms in most applications will not accept the lift of a 280H or larger camshaft without binding.
- Never continue cranking motor if it doesn't start immediately.

COMP Cams' Camshaft Installation Tools

SPORTSMAN DEGREE WHEEL



This 9" diameter degree wheel provides exceptional precision and accuracy at an economical price. It's size allows use on the engine stand or with the engine still in the vehicle. The high-contrast black on white screen printed design makes it easy to read, and easy to clean. This handy degree wheel can be bolted onto most harmonic balancers, or used with one of our crankshaft sockets (shown below).

4790 9" Sportsman Degree Wheel
4794 Wire Degree Wheel Pointer

PROFESSIONAL DEGREE WHEEL

This giant 16" diameter Pro Degree Wheel is machined from a 1/4" thick aluminum plate, then red anodized and precision engraved. The open design allows degree bushing changes while the wheel is still on the engine. The 1" center hole allows it to work with our crankshaft sockets (shown below), or use the included reducer bushings along with a balancer bolt. This extreme precision tool is found in most Winston Cup shops and is a must for any professional racer or engine builder.

4791-1 16" Pro Degree Wheel

CRANKSHAFT SOCKETS

When slipped on the end of a crankshaft, these specially designed 1/2" drive sockets allow you to rotate the engine assembly. These sockets also provide a great way to attach our #4790 or #4791 degree wheel to the engine. Our unique design incorporates a knurled retaining nut that sandwiches the degree wheel and holds it in place. This nut can be loosened while on the crank snout so that the wheel can be turned independent of the engine when finding TDC.

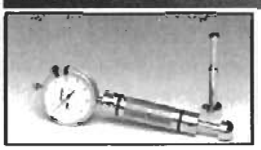
4793 Chevy Small Block, 90° V6, and GM 4 cylinder
1.255" ID with 3/16" keyway
4797 Chevy Big Block - 1.610" ID with 3/16" keyway
4798 All Ford, Buick and Pontiac V8 -1.385" ID with 3/16" and 1/4" keyways
4799 All Chrysler & Olds V8 (also fits some blowers) -
1.542" ID with a 3/16" and two 1/4" keyways 180° apart

CAMSHAFT DEGREE KIT

Competition Cams has assembled this kit with all the components necessary to degree a camshaft in most popular engines. Everything comes packed in a foam lined plastic carrying case for storage.

4796 Universal Cam Degree Kit
Kit includes: 9" Degree Wheel (#4790)
Cam Checking Fixture (#4902)
0-1" Travel Dial Indicator (#4909)
VHS Cam Degree Video (#190)
Wire Degree Wheel Pointer (#4794)
TDC Piston Stop (#4795)
2 Lightweight Checking Springs (#4758)
Cam Degreeing Instruction Booklet (#145)

CAM DEGREEING TOOLS



This innovative tool actually slides down into the lifter bore and rides on top of the camshaft in order to measure lobe lift and base circle runout. Each tool includes two followers, one for flat tappet or hydraulic cams and one for rollers. The built in o-ring holds the tool firmly in the lifter bore and a 1" travel dial indicator (not included) reads cam lift to .001". Two models are available and each one is double ended. Part# 4925 fits GM (.842" dia.) and Ford (.875" dia.) blocks. while part# 4926 fits Chrysler (.904" dia.) and Top Fuel (1.0 dia.) lifter bores.

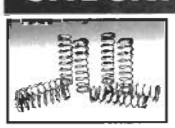
4925 GM and Ford Cam Degree Tool
4926 Chrysler and Top Fuel Cam Degree Tool
4927 Extension - For Use On Hemi-Design Blocks
4909 Optional 0-1" Travel Dial Indicator

TOP DEAD CENTER STOPS

A must when degreeing in a cam, these tools positively stop the piston in order to find top dead center. The bolt style screws into the spark plug hole, while the plate type bolts across any cylinder bore when the heads are off.

4933 Deck Plate Style - Heads Off (universal)
4795 14mm Bolt Style - Heads On (most engines)
4792 18mm Bolt Style - Heads On (big block Ford)

CHECKING SPRINGS

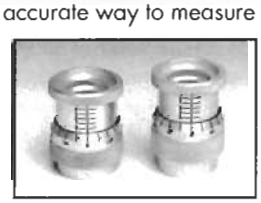


These low tension Checking Springs can be installed by hand in place of valve springs in order to simplify measuring piston to valve clearance, rocker arm ratio, cam degreeing, etc. This set of two springs is enough for one cylinder, and should be in every engine builders tool box.

4758-2 Low Tension Checking Springs - Set of Two

VALVE SPRING HEIGHT MICS

This is by far the quickest, easiest, and most accurate way to measure valve spring installed height. Our height mics install just like a valve spring, then the tool is expanded until it has fully seated the valve, locks, and retainer. This simulated seat pressure is what allows ultra precise readings. The tool is then read like a micrometer and is accurate to .001".



4928 1.400" to 1.800" Range Height Mic (4&6 cylinder engines)
4929 1.600" to 2.100" Range Height Mic (most V8's)

TELESCOPING GAGE SET

These gages are used to measure slots, grooves, recesses, cylinders, etc., and are especially useful for measuring valve spring installed height. Each set contains six gages covering a total range of 5/16" to 6", all enclosed in a handy storage pouch.

5320 Telescoping Gage Set - 5/16" to 6" Range

NOTES

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