

Installation Instructions for 200000 to 200071 & 200100 to 200171 Camshafts

READ CAREFULLY AND COMPLETELY BEFORE INSTALLATION

WARNING: NEW LIFTERS MUST BE INSTALLED WITH YOUR NEW CAMSHAFT.

Prior to installation:

- Check the compatibility of the camshaft with the remainder of the valve train components (valve springs, rockers, etc.)
- On race type, high load spring applications, use lighter load springs or remove the inner spring (dual spring application) just for break-in.

Engine Oil Selection

Today's engine oil is just not the same as it used to be, due to ever tightening environmental regulations. The EPA has done a great job in reducing emissions and the effects of some of the ingredients found in traditional oils; however these changes to the oil have only made life tougher on your flat tappet camshaft. The lubricity of the oil and specifically the reduction of the important anti-wear additives such as zinc and phosphorus, which help break-in and overall camshaft life, have been drastically reduced. In terms of oil selection, we recommend a high "ZDDP", Zinc Dialkyl Dithiophosphate, content oil for the break-in procedure and regular operation. There are several companies that are now offering specialized "race/off-road" oils, high in anti-friction and anti-wear content, to combat this specific problem. These oils carry the SL rating and contain up to 1000 ppm of Zinc/Phosphorous (the Zinc content in today's "off-the-shelf" oils have been reduced upwards of 20% since 2001 and approximately 35% since 1997). We highly recommend using **JEGS Break-In/Engine Oil Supplement – 555-28060** - during break-in and with each oil change.

CAUTION: We do not recommend the use of synthetic oils for "break-in". Prior to installing the camshaft and lifters, it is recommended that the crankcase be drained and filled with new, clean oil. The oil filter should also be changed at this time. Proper flat tappet camshaft break-in starts with the cam installation and includes the following steps:

1. Before installing the camshaft and lifters, wash them thoroughly in clean mineral spirits to remove the rust preventative that is placed on the cam before shipping.
NOTE: As a "rule of thumb", always thoroughly clean any part before installing it in an engine. Never "assume" that the parts are cleaned before packaging. During shipping, packaging material can rub into the component surface and must be removed!
2. DO NOT "pump-up" hydraulic lifters before use. This can cause the lifters to hold a valve open during engine cranking, which will cause low compression. The low compression will delay engine start-up and is very detrimental to proper camshaft "break-in".

Flat Tappet Camshaft Installation

JEGS FLAT TAPPET CAMSHAFT INSTALLATION INSTRUCTIONS

1. Disconnect the battery, drain the cooling system, and remove the radiator. Remove all accessories necessary to make the cam, lifters, and timing chain accessible. Rotate the crankshaft slowly until the timing marks are aligned.
2. Remove the camshaft timing sprocket and the timing chain. Using a cam removal/installation tool, **JEGS Part # 555-80598 or 555-80599**, or by reinstalling the cam sprocket slowly remove the camshaft from the block. Excessive force is not required. If the camshaft can't be removed easily, stop and look for the obstruction. (Such as lifters, fuel pump rod, distributor gears, etc.) Clean the new cam with mineral spirits, or equivalent solvent. Then, using **JEGS Assembly Lube, Part # 555-28000**, coat all of the lobes and distributor gear. Lubricate the bearing journals using a top quality, petroleum-based oil. It is also highly recommended that you pour a bottle of **JEGS Engine Break-In/Engine Oil Supplement, Part # 555-28060**, into the engine to further fortify the initial break-in oil. We do not recommend the use of synthetic oils or other additives with our cams and lifters during break-in.



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3. Carefully slide your cam into the block using the removal/installation tool or the cam sprocket. Be careful not to damage the cam bearings.

4. Remove the cam removal/installation tool or cam sprocket, install a new timing chain, and bolt the assembly in place. Make sure your timing marks are aligned properly. Consult your engine manual for proper alignment. Tighten the cam sprocket retaining bolts to correct torque specifications. This is very important as cam damage can be caused by the cam gear coming loose due to improperly torqued bolts or worn keys and keyways. If the gear loosens, the cam will slide back into the block causing the lifters to hit the adjacent lobes and bearing journals.

NOTE: Thread locking compound should be applied to the threads of all camshaft timing gear bolts. Be sure to apply proper torque to the bolts, as well. A camshaft bolt locking plate, **JEGS Part # 555-20305**, is recommended for Chevrolet 262-400 and 396-454 cubic inch engines.

Several cams require a plate that bolts to the block with a spacer between the cam gear and the front cam bearing journal. Some replacement gears have the spacer made on the gear. If so, make sure the original spacer is not used. To check gear alignment, put a straightedge across the timing gears from top to bottom. To verify that you have the correct spacer to cam gear combination, check that the camshaft end play is .004" to .008". (This procedure is for engines with cam retaining plates only.)

Many 1972 and later Ford-Mercury V-8 engines are originally equipped with a retarded crankshaft sprocket. This may cause idling and performance problems when installing aftermarket camshafts. Eliminate this problem by installing a pre-1972 crankshaft sprocket, (the non-retarded sprocket will have the alignment dot and keyway slot directly in line with each other), or by degreasing in your camshaft, or with appropriate JEGS timing chain and gear set.

5. To help prevent premature lobe wear, **new lifters must be installed** with this new camshaft. (No matter how little running time is on the "old" lifters.) O.E.M. lifters are acceptable, but we recommend new JEGS lifters for maximum reliability. Coat the bottom of the lifters, cam lobes and distributor gear with **JEGS Assembly Lube, Part # 555-28000**.

6. If cylinder head machining capabilities are not available or desired, and stock springs and retainers are used, make certain spring travel from assembled height to coil bind is a minimum of .060" more than the gross lift of the cam. Contact JEGS for valve spring and retainer kits that use stock diameter springs and require no head machining.

7. As a general rule, any cam with the same, or less, lift than any of our milder series cams for any given engine, should have a safe amount of piston to valve clearance if the engine, piston, cylinder head combination is stock. When using cams with higher lift, or engines with internal engine modifications to pistons and/or cylinder heads to increase compression, piston to valve clearance must be checked. Check with modeling clay when assembling the engine. **Minimum clearance is .080" intake and .100" exhaust.**

8. On engines with separate adjustable rocker arms such as a small block Chevrolet, we recommend installing the pushrods and rocker arms on one cylinder at a time and adjusting the valves on that particular cylinder. Do not tighten the adjusting nut down before adjusting the valves. If the adjustment is too tight this will cause the valve to hit the piston when you turn the engine over, resulting in bent valves, bent or broken pushrods, rocker arm studs to be pulled out of the head, and premature cam wear. On engines with shaft mounted adjustable rocker arms, back off all adjusters all the way before installing the assembly. Make sure the pushrod is in the tappet and in the rocker arm seat when making valve adjustments. For hydraulic lifter camshaft valve adjustment, turn the engine in the normal direction of rotation until the exhaust lifter on the cylinder that you're adjusting starts to move up, then adjust the intake valve on that cylinder to zero lash with no preload, then 1/2 to 1 full turn more. Turn the engine over again until the intake lifter has come to full lift and then is almost all the way back down. Now, set the exhaust valve to zero lash, then 1/2 to 1 full turn more. Continue the above procedure for each cylinder until all valves are adjusted the same. This procedure will give you the correct lifter preload for any hydraulic lifter cam with adjustable rocker arms. If your engine has non-adjustable rocker arms, a lifter pre-load of .060" to .090" must be maintained. Use the adjusting sequence as above to insure that the lifter is on the heel of the cam when preload is measured. Generally, pushrods for each cylinder should be the same unless valve stem heights are not correctly matched. When checking lifter preload make sure the valve is not open on the one you are checking. You may need to wait a few minutes for the lifter to bleed down. It may be necessary to change pushrod length, shim rocker stands or shafts, install straight screw-in studs in place of stock bottleneck type, use set adjusting nuts that feature socket head set screws, use allen set adjusting nuts, or machine the cylinder heads for adjustable rocker arms, studs and guide plates.



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9. Clean all parts and gasket surfaces; install new gaskets and re-assemble the engine.

10. Rotate the crankshaft until the number one cylinder is coming up the compression stroke, and then align the timing mark on the damper with the recommended factory initial timing setting. On the compression stroke, both valves will be closed. Install the distributor with rotor pointing to #1 cylinder spark plug wire in the cap.

JEGS FLAT TAPPET CAMSHAFT RECOMMENDED BREAK-IN PROCEDURE

11. If possible prime the oiling system. When priming, rotate the engine at least one complete revolution to assure oil gets to all valve train components. **Valve covers should be off to assure that all rockers are oiling.**

12. Preset the ignition timing to start the engine at a fast idle. **It is important that the static ignition timing be as close as possible and if the engine has a carburetor, it should be filled with fuel. The engine needs to start quickly without excessive cranking to insure immediate lubrication to the cam lobes.**

13. Start the engine and immediately bring to 3,000 rpm. Timing should be adjusted, as closely as possible, to reduce excessive heat or load during break-in. Get the engine running fairly smoothly and vary the engine speed from 1500-3000 RPM in a slow, to moderate, acceleration/deceleration cycle. During this time, be sure to check for any leaks and check out any unusual noises. If something doesn't sound right, shut the engine off and check out the source of the noise. Upon restart, resume the high idle speed cycling. Continue the varying "break-in" speed for 20- 30 minutes. This is necessary to provide proper lifter rotation to properly mate each lifter to its lobe.

14. Let the engine cool, and then drain the crankcase and properly dispose of the oil and oil filter. Refill the crankcase with a **premium petroleum-based oil**, not a synthetic oil, and **JEGS Engine Oil Supplement, Part # 555-28060**. At this point the initial "break-in" is complete. You can drive the vehicle in your normal manner. We recommend changing the oil, oil supplement, and filter after 500 miles. You might want to put another 5000 miles on the cam before switching to a synthetic, if that is your preference.

If you don't understand these instructions, please feel free to contact one of our Technical Consultants.

THE FAST AND EASY WAY TO CHECK HYDRAULIC LIFTER PRE-LOAD

One of the most important steps in hydraulic camshaft installation is checking the lifter preload. This is the distance that the pushrod has extended into the lifter and depressed the pushrod seat from its retaining ring. Accurately checking that this amount is correct (usually about a minimum of .060" to a maximum of .090") is critical to engine operation and life of the cam lobes, lifters and the engine's valve train itself. If your engine has too little, or no, lifter preload, the valve train will be very noisy when the engine is running. If your engine has too much lifter preload, it may idle roughly, have low manifold vacuum and poor low-end performance and may stall when put into gear. The most accurate method of checking lifter preload is by using **JEGS Part # 555-81623 Cam Checking Fixture**, or a dial indicator **JEGS Part # 555-81605**, but if you don't have a dial indicator, or don't know how to use one, there's an easy way that will work just as well. Follow the instructions in your repair manual and torque all the bolts in their proper sequence. You'll be ready to check lifter preload when you reach the step where you're ready to adjust the valve lash. First, allow a couple of minutes for the lifter to bleed-down after you have placed some preload on it. This bleed-down period must be allowed to remove any of the oil that the lifter may have inside.

Many new lifters (**you must use new lifters with any new cam installation**) come with some amount of oil in them, and you should allow one or two minutes for the bleed-down to occur.

Using the valve cover gasket surface of the cylinder head as a guide, lay a marking implement (metal scribe, etc.) flat on the reference guide. You'll be making two marks, so be sure your guide is flat and easily accessible. Now scribe a line on the pushrod. Next unbolt the rocker assembly and loosen the bolts so that the pushrod will stand free in the pushrod seat of the lifter. You'll also note that the pushrod seat in the lifter will be forced up against the snap ring in the top of the lifter by the plunger spring in the lifter.



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Now scribe another mark on the pushrod. You'll now have two marks on the pushrod. The difference between the two marks is the amount of travel that the pushrod made into the lifter, or the lifter preload.

You should maintain a minimum of .060" to a maximum of .090" lifter preload. In most installations you'll normally find that you should have either the correct amount of preload or too much pre-load.

Should you find that you have too little lifter preload, or you have free-play between the rocker arm and pushrod, you can remedy this problem by purchasing the correct length pushrods. Use a pushrod length checker, **JEGS Part # 555-80670** (this is a complete kit, consult our website or catalog for individual sizes).

Normally, you'll only need to check two pushrods per cylinder head, one each intake and exhaust. However, if the valve stem heights of all the valves in the head are uneven (measure from the spring seat to top of the valve) or different from factory specs (found in your manual) then it will be necessary to check lifter preload on each valve.

If you're having a valve job done on your head(s), you can ask the machinist to check valve stem height for you. This is actually a normal part of a properly done performance job, but you might want to ask anyway. The end result will allow you to lay a straightedge, **JEGS Part # 81640**, across all the valve stems on the assembled head and have valve stem height check the same across the stems.

On other engines, which have individual studs, shoulder bolts or pedestals it is still relatively easy to check lifter preload quick and easy. For those engines that have bottleneck type studs, we have special adjusting nuts that simplify the preload checking process. This type of stud has a shoulder that is larger than the thread and the adjustment nut is tightened down to the shoulder, thus eliminating any adjustment. Special adjusting nuts are tubular in design with a socket head set screws in the top. These nuts are also counterbored at the bottom so that they actually fit over the shoulder part of the stud.

These special adjusting nuts allow you to achieve the proper lifter preload as previously outlined. Tighten the adjusting nut down until you reach zero lash (no preload and no lash), then tighten it 1/2 to 1 turn more. Hold the nut with an end wrench and tighten the socket head set screw tight against the top of the stud. Continue this process until all of the valves have been adjusted.

On engines with pedestal or shoulder bolt mounted rocker arms you can use shims under the pedestal or shoulder to reduce the preload. If preload is too little, or there's none at all, you'll need to have longer than stock pushrods made. Use the same procedure outlined earlier to determine lifter preload and the amount longer your pushrods must be.

On engines that have individually mounted rocker arms, you should be able to achieve correct lifter preload by first tightening the adjusting nut or bolt down to zero lash. Now torque into place the adjusting nut or bolt by tightening 3/4 to 1 full turn of torque wrench rotation. This should place the pushrod at the correct lifter preload point. If for some reason you cannot achieve the correct lifter preload (.060" to .090") with 3/4 to 1 full turn tighter, then you'll have to follow the instructions outlined earlier and use the appropriate shim kit or longer than stock pushrods.

If you do not understand the previously mentioned steps, or you have additional problems: Stop before you make a mistake that will damage your new cam or valve train, and call one of our Technical Consultants.

TROUBLESHOOTING GUIDE

Adjust valve lash properly

All engines have a means for changing their valve lash. Be sure and follow the instructions included with the cam, lifters, or rocker arms. Take the extra time required to check the items mentioned before you fire up the engine.

Check for rocker arm interference

Installing a performance camshaft usually means that you are increasing the maximum valve lift over that the stock camshaft. On engines which have stud mounted rocker arms be sure and check the rocker arm slot that allows the rocker to pivot at maximum lift. Be sure that there is some slight amount (.060") of additional travel left in this slot when the valve is at maximum lift. Be sure that the rocker arm contacts only the valve tip, and not the valve spring or valve spring retainer.



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Check valve-to-piston clearance

Many times inexperienced or first time camshaft installers forget to check the engine's valve-to-piston clearance and end up by bending some, or all, of the engine's valves when they strike the piston. This is especially critical on an engine with domed pistons, or where the camshaft being installed has more duration and/or maximum valve lift than that of the previous cam. Check this clearance before you fire up the engine. Several ways can be used, the easiest being to use modeling clay placed atop the valve area of a piston and then bolting the cylinder head in place and torquing it to specs. Adjust the valves (don't forget to use the head gasket for an accurate clearance check) then rotate the engine by hand several times. Remove the head(s) and carefully peel off the clay and measure it with a micrometer. Allow a minimum clearance of .080" intake and .100" exhaust.

Bent pushrods means mechanical interference

If you bend one, two or several pushrods for no apparent reason, then you are experiencing some form of definite mechanical interference in the engine's valve train. Check for rocker arm to stud interference. Valve spring coil bind, interference between the retainer and the valve seal or retainer and valve guide. Also, high RPM might be showing valve-to-piston clearance problems that are causing your valves to strike the pistons and then bending the pushrods. If this occurs, and you suspect valve-to-piston clearance problems, it's a good idea to also check for bent, or leaking valves, and possible piston damage.

Never advance or retard your cam timing without first taking the time to "degree in" the camshaft in the engine

A cam change that doesn't seem to have enough low-end power might be an indication. Frequently, retarded cam timing is due to factory retarded timing gears. Always degree-in the cam before you make any timing changes using **JEGS Part # 555-81621 Degree Wheel Kit**.

Be sure and properly lube the cam

Many cams are ruined in the first couple of minutes of their life when they are installed dry or improperly lubricated. Be sure and follow the instructions included with the camshaft or correct pre-lubrication of the cam and lifters before you fire up the engine. Using JEGS 555-28000 Assembly Lube liberally will help prevent this.

Follow cam break-in instructions - especially with regards to oil and filter replacement

Dirty oil and clogged, old oil filters mean abrasives in the oiling system and wear for the camshaft, lifters and all other engine components as well! Spend a couple of extra dollars and buy high quality oil, and filters, and above all, change both frequently. This will add life to not only cam and lifters, but the entire engine assembly as well.

Breaking rocker arm pushrod seats

We have found this to be a somewhat common problem, especially when an engine has several thousand miles of usage on the rockers. This usually occurs when a cam is installed that has a higher lift than the cam previously used. The additional amount of travel required of the rocker arm tends to relocate the load generated by the valve train and concentrates it partially in the already worn area of the rocker arm pushrod seat and partially in the area not yet worn. The result is a concentration of this loading in an area of thinner metal, and breaking through or punching out of the pushrod seat often occurs. The cure is to install new stock type steel rocker arms, or a set of JEGS aluminum rockers.

Accessories

JEGS Engine Oil Supplement/Break-In Oil – 555-28060

JEGS Assembly Lube – 555-28000

JEGS Degree Wheel Kit – 555-81621

JEGS Cam Checking Fixture – 555-81623

JEGS TDC Locator – 555-80524

JEGS Camshaft Bushings – 555-20300 – 555-20302

JEGS Intake Gaskets – Consult Catalog or Website for Part Number

JEGS Harmonic Balancers – Consult Catalog or Website for Part Number

JEGS Rocker Arms – Consult Catalog or Website for Part Number

JEGS Timing Chains and Gears – Consult Catalog or Website for Part Number



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