



## Cylinder Head Installation Tips

These instructions are intended to aid and assist in the installation of the cylinder heads. This is not intended to be a comprehensive set of instructions from start to finish.

The installation of cylinder heads requires knowledge applicable to the engine family you are working on. If you are not familiar with this information we strongly suggest getting a professional's assistance with experience in the engine family you have.

### **IMPORTANT:**

Apply a light coating of anti-seize to the spark plugs to ensure a long thread life.

### **\*WARNING\***

Piston dome to cylinder head clearance must be checked prior to the final assembly of engine. Piston to valve clearance also needs to be checked, pay special attention to the outside edge of the valve to the inside edge of the valve relief in the piston.

Both the radial valve clearance (clearance from the valve relief pocket to the valve edge when in the pocket) as well as vertical valve clearance must be checked. The only accurate way to do this is with a combination of the clay method to check for radial clearance as well as using a cam degree wheel and dial indicator on the valve to check for vertical valve clearance.

### **COOLANT:**

It is important to maintain a 50/50 mix of antifreeze in the cooling system to prevent corrosion of aluminum heads. Use only distilled water, do not use tap water.

### **HEAD BOLTS & STUDS**

Livernois Motorsports recommends Livernois high quality head studs or ARP head studs or head bolts with hardened washers. These must be used to prevent galling of aluminum cylinder heads. For maximum head gasket clamping Livernois Motorsports recommends head stud kits.

Note: You cannot re-use the factory head bolts, as they are a "torque to yield" design and can only be used once.

Please read and follow these guidelines closely.

1. Establish a clean work area. Contamination from foreign particles and debris will significantly increase the chance of damage to either the cylinder heads or the entire engine. This damage may be minor enough to cause only performance loss, however, in some cases; it could cause severe engine damage or failure.
2. When removing the cylinder heads from their packaging, be sure to remove all shipping and packaging material. Livernois Motorsports thoroughly cleaned your cylinder heads prior to shipment, however, we suggest that you inspect them for loose packaging material and use compressed air to blow them out prior to installation.
3. It is recommended that you take digital photos of the engine during disassembly. You should also place the parts in a bag and label them as removed. This will make installation of the new cylinder heads much easier.
4. Remove all old gasket material and clean the block surface. The mating surface of the block should be clean and free of any oils. (Oil on the surface of the block may lead to water leaks).
5. Before installing the new cylinder heads and gaskets, take a look at the photos you took in step 3 to verify that everything is in the correct location and you have everything required for re-assembly.

Note: Livernois Motorsports recommends Comet MLS head gaskets for all performance engine applications.

6. After carefully prepping the mating surfaces and laying out all necessary parts, you are ready to do a final check before re-assembly. Verify that all necessary parts are in place.
7. Prior to installing the MLS head gaskets, Livernois Motorsports recommends spraying a thin layer of Permatex copper coat onto both gasket surfaces. This will ensure maximum safety against water leaks.

Note: Before installing the head gaskets or cylinder heads, allow the copper coat to become tacky. Once tacky, you can proceed with the installation.

8. After the cylinder heads are installed, you can then tighten all of the fasteners to their recommended torque value. It is recommended to use the torque procedure associated with the fastener you are using. Be sure to follow the correct sequence and number of steps when performing the torque procedure.

9. After the heads are torqued to spec, you can continue with the remaining portions of the engine assembly process.

### **Ford Modular Cylinder Head Specifics**

Modular Ford 4.6/5.4 cylinder heads have specific items that should be noted while doing a head and cam swap.

- While every head in the modular family will bolt to any modular block, it is important to make sure that all other timing components and accessories will fit between the different model years and types of cylinder heads.
- Modular overhead cam engines employ hydraulic lash adjusters for the valvetrain. Your Livernois Motorsports cylinder heads are setup and machined to use the stock tolerance for the lash adjuster preload and clearance, however with the addition of other components such as camshafts and aftermarket parts you should verify that the lash is indeed within the factory range. We use the factory spec for lash and found that it works very well in most applications. You must still verify the lash to be correct before finalizing the installation otherwise engine damage or reduced performance could result.
- Timing of the engine and camshafts is especially important on modular engines. Since the spring pressure can cause the camshafts to roll in the heads, it is important to ensure the pistons are oriented in the correct position before installing the heads. Failure to put the pistons in the correct “safe spot” before installing the heads can damage both the pistons and the cylinder heads. This is a critical step that requires careful attention to ensure correct installation without damage.
- When installing aftermarket camshafts and cylinder heads, it is critical that piston to valve clearance is checked, since no two engines are the same. It is important to verify that enough clearance exists between the piston and the valve throughout the entire running cycle of the engine. If the clearance is not adequate, failure to check piston to valve can lead to catastrophic engine damage.
- 3-Valve Modular engines require a longer head bolt/stud than 2-Valve and 4-Valve applications. While the standard length bolt/stud will work by unscrewing it slightly, we recommend using the 3-Valve specific stud manufactured by ARP.

## GM LS-Series Cylinder Head Specifics

GM LS-Series Engines have specific items that should be noted while doing a cylinder head and cam swap.

- GM LS-Series engines use lifter buckets to stabilize the lifters during operation. These lifter buckets are also designed to hold the lifter up out of the way so that the camshaft can be removed without removing the heads. Be very careful if employing this method, as there is no guarantee that the bucket will hold the lifter. This could result in a lifter falling into the engine and would then require removal of the oil pan to retrieve.
- GM LS-Series cylinder heads use a rocker arm bar attached to the heads as the point of contact and stabilization for the rocker arms. This system has no adjustment and uses only a torque value for the rocker arm bolt. The pushrod length is the only adjustment that can be made to get the correct lifter preload. While the Livernois Motorsports cylinder heads are designed around a stock valve-tip height so that stock pushrod lengths may be used, you must still check to ensure that the preload is correct for operation.
- When installing an aftermarket camshaft and cylinder heads, it is critical that piston to valve clearance is checked, since no two engines are the same. It is important to verify that enough clearance exists between the piston and the valve throughout the entire running cycle of the engine. If the clearance is not adequate, failure to check piston to valve can lead to catastrophic engine damage.
- There are two different designs for head bolt length for LS-Series engines. There is an early design where all but two bolts are the same length, and a later design where all the bolts are the same length. Ensure that the bolts or studs that you are using fit the year of the engine you are working on.
- GM LS-Series cam gears are different throughout the model years. They carry different designs on the face of the gear for the cam sensor to pickup. If you are adding an aftermarket gear ensure that it carries the same configuration as the stock gear.

## Warnings

- Livernois Motorsports recommends that only experienced individuals, knowledgeable in Modular and LS-Series engines do the installation.
- Failure to check for piston to valve clearance may result in failure to both the cylinder head and engine. Piston to valve clearance should always be checked.
- Correct lash and preload are critical for the engine to operate normally, and should always be checked when installing new cylinder heads and aftermarket parts.
- Cleanliness is of utmost importance. Livernois Motorsports takes extreme measures when it comes to keeping parts and components clean. Your cylinder heads are in placed into sealed bags after final assembly and are completely free of any debris. It is important to ensure that same level of cleanliness is carried over during the installation. Failure to maintain properly cleanliness can lead to engine failure.
- Livernois Motorsports camshafts are designed to work with all of our spring packages. If using another camshaft, it is important to verify that the camshaft you chose will work with the springs. Contact a Livernois Motorsports representative if you are using another camshaft profile.
- When installing aftermarket parts such as cylinder heads and camshaft(s) it is important to remember that the existing engine and stock parts may need to be upgraded for compatibility and durability. Some stock parts may be pushed beyond there strength limits, which may cause them to fail.
- After installing cylinder heads and camshaft(s), it's important to make sure that the existing tune be checked and modified as necessary. Changes such as cylinder head and camshaft(s) will alter the engines running condition and will require the tune be adjusted for maximum performance and durability.

Livernois Motorsports will provide technical assistance via phone and email, but cannot "build" the entire engine via these means. Please call us at 313-561-5500 with any questions or concerns you may have.