



Short Block Instructions

Congratulations on your purchase of a Brian Tooley Racing Short Block! We have put together our favorite combinations of engine components into assembled short block packages while utilizing the latest engine machining processes to give you a solid and dependable performance foundation to build upon. These are some guidelines to be followed to help take your short block through the next steps of the build process. There are also several books and online resources for more information.

Your short block comes with a corrosion inhibitor engine bag, keep it wrapped up until it is time for assembly. If you are not assembling your engine for years down the road or you are in a high humidity environment, some extra steps such as lubing the cylinder walls with a rust preventative every so often would be recommended.

You have no doubt heard the quote that “cleanliness is close to godliness” - engine builds are the prime example, where you cannot have too clean of a build area. Your engine was built with care and attention to detail in a sealed clean engine room, so to not waste this effort which you paid for, your workstation or shop should not be an extremely dirty garage, dusty carport, or any areas subjected to the outside environment. The minimum expectation would be a clean shop environment and an experienced technician as the final builder. Likewise the engine parts you put onto your engine should be cleansed thoroughly, with no debris or contaminated oil from the previous build leftover. **Remember to flush the engine oil cooler if so equipped.**

Using an engine stand to assemble your engine is preferred. This helps get the engine at the right height and line-of-site to see the tasks you are performing clearly. Yes we have all seen someone finish assembling a junkyard dog engine on a pallet in the bed of a pickup truck, this is not the engine for that process.

A new oil pump is required for a new short block. We recommend the Melling 10295 oil pump, which is a standard volume higher pressure oil pump. Naturally a forged engine and performance based oil clearances are set to looser tolerances than OEM specifications, so it is expected to have slightly lower oil pressure than this same oil pump would provide on a completely stock engine. Thicker oil viscosity than stock is also normal to use such as 15w40 or 15w50, especially so in hotter climates or endurance applications.

The OEM windage tray in stroker applications (and some stock stroke/forged rod builds) must be spaced out away from the crankshaft throws for clearance. This is easily accomplished with windage tray spacers/washers over the windage tray/main bolt studs. General rule of thumb is .050 inch of clearance for rotating parts. Use a flashlight if needed and turn the engine over to check all rod bolts to windage tray clearance as the engine is rotated. (Note that the 4th Gen LS1 F-Body oil pan may have similar interference on the first rod pin rods and need some manual grinding for clearance).

When the windage tray is spaced, this also shifts the pickup tube height away from the engine, and closer to the sump of the oil pan. If this clearance is not adjusted, an oil volume issue will arise. The oil pan to pickup clearance must be set to approximately 3/8 inch. While you can use a straight edge and calipers to measure the depth of the pickup tube versus sump depth. It is easier to use clay for this measurement. By using tape over the pickup tube screen, and then a small ball of clay or play-doh on top of the tape you can check this clearance easily. Install the oil pan over the measuring clay, install a couple bolts and then remove the pan and measure the



clay. Adjust the pickup tube as necessary to gain the clearance needed. Always use a new and correct oil pickup tube O-ring with plenty of assembly lube to install.

The camshaft thrust plate must be new, it is technically a gasket and a reused thrust plate can cause an internal oil leak and bleed off engine oil pressure. AFM/DOD valley plates on Gen IV blocks such as the LS3 should have good fresh block-off O-rings, and if the AFM/DOD is missing such as on the Dart or LSX block, these O-rings can be discarded.

We highly recommend investing in premium quality lifters for your new engine, such as the Johnson 2110R lifters. Reusing lifters is a no-no and can reintroduce contaminants into the new engine. Regardless of the source, clean the new lifters thoroughly. Using liquid assembly lube with cling properties such as from VP Racing (Engine Assembly Lube) or Permatex Red Assembly Lube available from most major parts stores. Lubricate the roller bearings generously and also oil the housing of the lifter for installation. Soaking is not recommended or necessary as the lifters will get immediate oil internally upon startup, friction points are the most critical.

Notes on oil pans with stroker crankshafts: OEM oil pans are designed for non-stroker crankshafts, the extra stroke of these builds requires some attention to pan fitment. Aftermarket oil pans have less intrusion (such as the Holley 302-3) as these are often designed with longer stroke crankshafts in mind. As mentioned above, the 4th Gen Camaro/Firebird often needs some extra clearance for the #1 rod pin. The C5 and C6 Corvette wet-sump oil pans have some internal structure ribs that need some work as the relocated windage tray often hits the oil pan on these support ribs - sometimes the pickup tube will hit the pan gusseting as well. GTO oil pans have internal oil transfer tubes that require some extra love with a hammer where the rods get close. Truck pans sometimes need internal bosses ground down to fit. Check these areas when testing oil pan fitment.

Gen IV Oil pans with AFM/DOD bleed valves near the oil filter - such as the 2010-2015 5th Gen Camaro, 2008-2009 G8's and 2007+ NNBS GM trucks **should be removed and plugged**. This valve dumps oil pressure above ~52 psi internally and can starve engine bearings of needed oil in performance applications. To replace this valve, you can use Improved Racing P/N [PO-M14-KIT](#) or also by simply using a Dorman or Help replacement oil drain plug in the M14 x 1.5mm size from your local auto parts store. Use loctite on this simple yet effective plug solution.

There are many other assembly processes that need to be performed while building a long block from a short block. This document covers some of the basics and known problem areas meant to help you have an easier task, but it is no replacement for a service manual or good step-by-step performance book. The top end of the engine, the front and rear covers, and sensors all bolt on fairly easily and are universally the same whether OEM or aftermarket. Pay attention to things like degreasing camshaft, proper quench, installing the head gaskets in the correct orientation and measuring pushrod length and lifter preload. Once fully assembled and installed, you can add the specified break-in oil quantity for your vehicle to the crankcase.

Install a base tune for the engine. **Then follow the break-in instructions attached.**