

500 Horsepower Olds 455c.i.d. build

Technical Article part 3

This month we review the assembly steps and procedures for taking the 300+ components of this engine and mating them all together to create Art's Olds big block engine that will power his 50' Olds street rod.

The first step with every build is insuring all the parts are accounted for and are completely washed and free from any machining debris, dust, lint, or left over grease from the original build. Having an organized table area and work bench that allows all the parts to be staged, inventoried, and kept clean once prepped is very important.

Washing the block thoroughly with warm soapy water and using a bore brush set to clean the oil galleys, lifter bores, and water passages is the next step along with running a bottom tap through every bolt hole, followed by drying the block quickly with clean and dry compressed air to minimize flash rusting of the machined surfaces and blowing out any last particles. Next is washing all the internal components in solvent, including ALL parts that are new and in sealed packages such as bolts, camshaft, lifters, roller rockers, etc.. These parts while maybe void of baked on oil / grease or machining debris, have either a light coat of machining oil or even cosmoline on them to protect the parts from rust while on the shelf or being shipped and these coatings must be completely cleaned off to avoid contamination of the assembly process.

Once the parts are all cleaned and laid out in an organized manner, the first step I take is measuring all the components to insure the bearings, rings, pistons, crank, lifters, as well as all the block machining and rod resizing math out to the proper clearances. At this point we start with filing the purposely oversize ordered rings (.005 over) to establish the exact ring gap we need for each cylinder. The recommended gap varies depending on the induction system (blown, nitrous, normally aspirated) as well as piston type and cylinder wall finish. This process usually takes several hours to complete with a special ring filing tool and several double checks along the way to insure we get it dead on. Once the rings are all filed to the correct gap, they can be installed on the pistons, taking note in which side of the ring is up based again on the manufacturer's instructions and ring type. In this case we used a "single moly" ring package which means the top compression ring is made of chrome moly steel while the second compression ring is made of ductile (cast) iron and the oil control ring being a three piece steel assembly.

The next step is to prepare the block for assembly which includes for me first painting the block with a quality heat resistant engine enamel paint such as Rustolem or Krylon brand (or SEM if painting an original color), in this case we painted Art's block black. It usually takes a little over one spray can for the block alone. Take your time hear and mask off all machined surfaces first for a clean result. installing

new oil galley plugs is the next step, making sure we use the proper plugs in the correct locations as two of the plugs have an oil spit hole in the center of them, one for oiling the timing chain and one for oiling the distributor gear. The other two galley plugs are standard block off plugs. A slight coat of liquid Teflon sealer on the threads seals these nicely. Next we installed the freeze plugs using a light coat of Permatex Aviation sealer on the plug edges and block surface then tapped them in with a purpose built tool for freeze plugs that drives them in using the edges and not the center of the plug cup. Using a socket in the center of the freeze plug will cause it to pucker inward slightly losing some of the interference fit and possibly allowing it to pop out under pressure and vibration later down the road. Lastly we re-install the small steel baffle in the timing cover area of the block (just under the oil fill tube opening) which deflects oil slinging off the timing chain from traveling back up the oil fill tube and making a mess of your engine compartment. Do not forget this piece as it will be a very big headache later to deal with!

Now we can prepare to place the crankshaft in the block by first removing the main caps if not already done, and making note of their placement order and insuring they are all properly marked with relation to their location. Placing the main bearings in their respective saddles and caps is the next step, making sure to completely seat the bearings in each cap and block journal, flushing out the bearing edges with the machine surfaces as closely as possible. At this point, some builders dry install the crank with a product called "Plastigauge" which is used to check for bearing clearance. While this is not as accurate as using a dial bore gauge / micrometer, it does give a fairly good indication where you are with final oil clearance. Next is to install the rear main seal, in this case a neoprene two piece seal which is an upgrade from the original rope type seal Olds used on all V-8's that were produced. This seal requires a slight coat of the same Permatex sealer we used on the freeze plugs, this time sparingly brushed into the cap and block grove the seal seats into. The seal is then inserted (lip forward) into the grooves and the seams of the seal are staggered in relation to the rear cap / block seam to insure there will not be any seepage. Now assembly lube is applied to all bearing surfaces and the crank journals and the crank is gently lowered into the main saddles. The caps are now re-installed in the proper order and seated in the block register (step), finally being torqued in place following the proper torque sequence working from the center outward in both directions and torqueing the bolts in steps and not all at once. One important note here, whether you are using bolts or studs here, the threads must be coated with the proper lubricant to avoid "torque scatter" which is uneven stretch or torque on the bolt which will lead to cap walk and eventually bearing failure. Different types of fasteners require different lubricants so check with the hardware manufacturer or at the very least, use the Oldsmobile recommendation which was 30wt oil.

The final step of insuring the crankshaft is installed properly is checking the end play with a feeler gauge or a magnetic dial indicator as well as hand spinning the crankshaft to feel for any "tight spots" indicating an out of round crank journal or improperly seated bearing. Proper end play is important as the crank does walk back and forth in a block with acceleration, gear changes, clutch engagement, and even fan belt loading so again we follow the factory recommendations here to allow a little play, but not excessive play as this can damage the crank, bearings, and even the timing chain assembly.

Now we move on to installing the rod / piston assemblies into their respective bores. First we need to install the rings on the pistons and this is done with a special ring spreader tool which is similar to snap ring pliers in that they work in the reverse of regular pliers. The rings are inserted into the edge of the tool and gently spread open just enough to fit over the piston and drop into their respective grooves. Once all the rings are installed you can clock the gaps opposite from each other for initial assembly but this is not absolutely critical as the rings rotate in the grooves while the engine is running and will change orientation hundreds of times during an engine's life. One of the most critical parts of this process is making sure the piston wrist pins are adequately lubed before being installed since it will take some time on initial fire up for any splash oil to reach this area and you don't want wrist pin galling. The next step is to install the bearing inserts in the rods and caps along with inserting rod bolt boots (plastic or rubber caps) over these bolts to avoid scarring the cylinder walls or crank while inserting the piston / rod assemblies into the block. Now we lube the cylinder walls liberally with a specially formulated light weight oil designed for this use that will not leave behind carbon deposits when burned which will upset proper ring sealing on initial fire up. Each rod assembly should be numbered to its respective cylinder and this is in part done because Olds rods are slightly offset to one side to allow adequate journal clearance and must be oriented correctly or the rod bearings will ride up on the cheek of the crank journal and eventually fail. Also it is important to orient the bearing tang notches and spit holes inboard facing the opposite rod on the journal, again to insure the rod offset is correct. Note; this was the very reason for the failure of two rods in Jeff Shadow's 69' Toronado motor as the rebuilder installed two rods backwards and the engine only lived for approximately 2,000 miles before having significant loss of oil pressure and ultimately bearing failure. Just before inserting each piston / rod, assembly lube is again liberally applied to each bearing surface and crank journal. Next we place one assembly at a time into the block, using a ring compressor tool to allow the assembly to fit into the block. Then gently tapping the assembly down the bore with a plastic dead blow hammer handle until the rod seats on the crankshaft journal. Once seated, the cap is installed and torqued in place, in this instance using ARP assembly lube on the bolts and torqueing to spec, again in steps and not all at once. After every rod / piston assembly is installed and torqued, the crank is turned by hand (socket and ratchet) to again feel for tight spots or abnormally tight rotation. Once all eight pistons are installed, it should still be fairly easy with a socket and ratchet to spin the entire rotating assembly by hand without assistance from a breaker bar or other leverage.

Next month we will move on to the final assembly stages of both the short block including the hydraulic roller camshaft as well as installing the aluminum cylinder heads and related valvetrain and setting up the proper geometry of the roller rockers.

As always, feel free to contact me if you have any questions regarding this build or one you may be contemplating..

Grant