500 Horsepower Olds 455c.i.d. build

Technical Article part 4

In the last tech article, we left off with the rotating assembly completed with all critical clearances checking out to this point. Now we move on to installing and dergreeing the camshaft and working towards buttoning up the engine.

The camshaft that was chosen for this build is a retrofit hydraulic roller camshaft system which requires a few special components to adapt it properly to the Olds block. The specifications for this camshaft are .560 / .555 lift, 278 / 282 advertised duration on a 110* lobe separation and 106* intake centerline. While this sounds fairly aggressive for the street, with a roller cam profile, this will behave well in Art's car with a power range from 1800 – 5600rpm.

The cam chosen is manufactured by Howards Cams and is made with a special billet steel core that allows using a stock type iron distributor gear rather than a special bronze gear as many other cam manufacturers require.

The main difference between roller and flat tappet cams is obviously the lifter design with roller cams having a "roller" on the end of the lifter while flat tappet cams utilize the slightly convex bottom of the lifter to ride directly on the cam lobe. Flat tappet cams purposely have some off center alignment of the lifter bore to the cam lobe to promote lifter rotation which minimizes wear and friction of the two metal to metal parts. When using a roller cam, the cam lobes must be centered on the lifter bore so that the roller on the lifter can properly follow the cam lobe. This requires stabilizing the roller cam in the block so it cannot walk back and forth like a flat tappet cam does. To do this we use a special brass spacer behind the cam flange at the front of the block in conjunction with a special cam bolt with a bronze bushing or bearing machined onto the snout to contact the backside of the timing cover to control the fore / aft movement of the cam. The clearances are rather tight here at .005-.010 max and must be checked and adjusted as needed prior to the timing cover being final installed. A corresponding steel shim spacer is also installed behind the crank gear to insure the timing chain is properly aligned and running true.

Once the basic cam installation is complete and the chain and gears are installed, aligning the timing marks as usual, we then "degree" the cam with a special degree wheel fixture and a dial indicator and check to see that the cam is within the manufacturers specifications on what we call "valve events" which is when in the rotation of the engine the intake and exhaust valves open and close. This is a very important step that I recommend all engine builders perform as I have found many different brands of timing chains are not accurate in their alignment marks, as well as most aftermarket harmonic balancers and sometimes even finding machining errors with the cam itself. This process takes a bit of time but insures the cam will deliver the expected power and performance.

Once the cam is installed and degreed, we can move on to installing the timing cover with a new front seal and then work towards closing up the bottom end with the new oil pan.

First we needed to install the new hi-volume oil pump and pickup along with a new heavier duty oil pump driveshaft that will resist twist at higher rpm's and oil pressure. Again you must be careful with this driveshaft as any replacement piece must have the press on retaining washer on it as well as be the correct length. The more common replacement unit from Milodon is too long and puts excessive load on the distributor bushings / bearings so pay close attention to this detail and check your new drive shaft against the original unit for proper length.

In this build, we replaced the factory hardware for attaching the oil pump with ARP stud type hardware for improved clamping force, then installed the oil pump pickup (bolt on type) using red locktite to insure it can never come loose and cause an oil pressure problem. I also remove the oil pump bottom cover and reinstall the four bolts with red locktite to make sure these wont vibrate loose either.

Now we measure the distance between the pan rail of the block and the bottom of the oil pump pickup and compare that dimension to the depth of the pan using a straight edge across the pan and measuring to the bottom of the pan. The pan depth should be no more than ½" deeper than the block to pickup dimension. This makes sure the pickup will always be submerged in oil and avoid sucking air or "cavitating" which will result in oil pressure loss and potential engine damage.

Sealing the pan in place takes a little care in aligning the gaskets and end seals and using a light coat of silicone sealer (black rtv or hi-temp orange). The key here is to take your time and don't overdo it with the silicone sealer as this can expand into the engine crankcase when tightening the pan, eventually falling off and clogging the pick up in the oil pump. The engine I am currently rebuilding for Dan Murphy in our club had this problem from a previous rebuild with the pump so badly clogged it was probably only operating at 50%-60% efficiency!

Once the pan is in place and the bolts are sequentially tightened to spec working from the center of the pan outwards on both sides, you can smooth out any silicone that oozed out and trim off the excess pan gasket material where it intersects the timing cover. Make sure the oil pan drain plug is tight at this point and we are now done with having the engine inverted on the stand and can now work on the top end.

The next step is to install the heads, in this case, Edelbrock aluminum cylinder heads that were redone / blueprinted by Bernard Mondello. I use a special multi-layer steel head gasket manufactured by Cometic for all aluminum head installations as these are the best sealing head gasket I have found for this type of application. The heads were torqued in place using ARP head bolts and were torqued to their spec using the special moly lube provided by ARP. I still followed the factory torque sequence, basically working from the center out on all bolts and step torqueing them, not bringing them up to full torque until the third or fourth tightening sequence. This insures even clamping force with no warpage of the head or overstressing a fastener.

Once the heads were in place, I could now work on valve train geometry and figure out the proper length of the new chrome moly steel pushrods we would be installing. Any time you do a semi-custom build such as this or even change to aluminum cylinder heads and adjustable valvetain, you will need to change the length of the pushrods from the factory length to regain proper rocker arm to valve tip geometry. I do this with a special adjustable pushrod that has a threaded adjustable end and then mock up one cylinder of valve gear including lifter, pushrod, rocker arm, and guide plate. I adjust for normal preload of the lifter then rotate the engine through an entire cycle to see where the rocker arm is riding on the tip of the valve, both in open and closed valve events. I adjust the pushrod length as needed to achieve travel of the rocker arm nose as close to center of the valve tip as possible during all positions, then disassemble and measure the adjustable pushrod so I can order the new units to the correct length. In all the new builds I perform, I use heavier duty 3/8" diameter chromemoly steel, hardened pushrods that also have the center oiling hole restricted down at one end to slow the oil flow to the top of the motor. Oldsmobile engines are well known for pushing way too much oil to the top of the engine during extended high rpm's with very slow drain back so by slowing the oil to the top of the engine, more oil stays in the pan and feeds the more critical areas of the motor like the main / rod bearings, and camshaft surfaces.

Once the new pushrods arrived, the entire valve train was assembled including the roller lifters, roller rockers, pushrods, rocker arm studs, and guide plates. Then all valves were hand adjusted to the proper lifter preload and locked in place with special "poly lock" adjustment nuts finishing up the complete valve train.

Next month we will finish up the assembly with installing the intake, oil filter housing, rear galley plugs, and other accessories in preparation for Art to pick up his motor and get it installed in the car.

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