500 Horsepower Olds 455c.i.d. build

Technical Article part 2

This month we will review the components being used in Art's big block build to set the stage for how we make the tried and true Olds 455 become a power plant producing more than one horsepower per cubic inch.

As was mentioned in the previous article, we started with a different block, this one being a 1968 vintage 455 block that was treated to an oven "bake" cleaning, bead blast, hot wash, then magnafluxed to check for cracks as well as sonic checked to determine the wall thickness of the cylinders. Once these steps were completed, the block was deemed suitable for use and an overbore of .060 which will make this engine have a final displacement of 468c.i.d.

Next was the block machining which consisted of align honing or "line boring" the main bearing bore to insure the crank will be dead straight in the block and have proper clearances. The main caps were fitted with high strength ARP studs with nuts and washers to replace the almost 50 year old factory bolts.Then the block was decked which squares the block with the crank centerline and also gives us a clean flat surface for proper head gasket sealing. The next step was to bore and hone the cylinders to the final new dimension (4.185) and this is done with a torque plate installed to duplicate the stress on the block of heads being torqued in place. Using this torque plate procedure insures the bore will actually be round and have the proper dimension / finish when the pistons and rings are actually under load during operation. Lastly new cam bearings are pressed into the cam bore saddles and the machine shop gives the finished block one last wash to remove machining oil and debris.

Next is the replacement crankshaft, in this case one that was used in our previous race engine build that we provided to Art for this build. This crankshaft is a factory "N" or nodular iron crankshaft which is considered to be good to the 600+ horsepower level when properly prepped. This crank was treated to a re-grind on the main and rod journals, the oil holes were cross drilled and chamfered to improve oil flow, the journals were all micro polished including the portion of the crank where the rear main seal rides, and the crank was Nitrided which is a hardening process done with heat, to improve the journal surface durability. The polishing process on the rear most portion of the crank where the seal rides is very important as these cranks were originally designed to be sealed with a rope seal. We are now using a neoprene seal which is a better material but is also more delicate and the crank originally actually had a somewhat knurled surface at the seal surface which the Olds engineers thought would help with the rope seal mating. This knurling is too rough for the neoprene seal and can cause premature wear as well as gaps under the seal lip and cause that pesky rear main oil leak our Oldsmobiles are famous for.

The connecting rods being used in this build also came from our previous race engine and were prepped with an even higher horsepower level in mind than what we are doing with Art's engine. These rods

were treated to a re-sizing to insure the crank end is perfectly round, new high strength ARP brand rod bolts are pressed in, each rod was magnafluxed to check for cracks, the forging seam in the beam of the rods was polished off to remove any “stress risers” that may lead to a crack in time, extra side clearance was machined into the sides of the rods (a common wear and heat problem with Olds rods) and the new pistons were pressed onto the rods with new high strength tool steel wrist pins.

The last machine shop process is balancing the rotating assembly which is done using “bob weights” assembled to match the weight of each rod / piston / ring set / bearing set that rides on each journal. In this case, we had this assembly “externally” balanced which is the same basic process the factory used when these motors were assembled originally. This process requires matching all the rod / piston assemblies to each other, sometimes requiring removal of material from the rods to equal them out. Then when the bob weights, as well as the flex plate and harmonic balancer are installed on the crank, weight is either removed or added to the crank throws to make everything balance out. A chart is then documented on the individual weights and provided with the balanced assembly just in case there is a need to replace a component in the future so it can be easily balanced to the rest of the assembly. All the machine shop work was provided by Dougans Racing Engines in Riverside Ca., a company I have been using exclusively for all our machine shop needs since the early 90’s with great success.

The heads being used in this build are the Edelbrock aluminum heads that were originally on Art’s other motor. These heads are being treated to a full rebuild including complete cleaning of the bare castings, a full competition level valve job, new valve springs and retainers to match the camshaft, port matching, surfacing, bolt hole chamfering, and other casting flaw detailing. This work is being performed by Bernard Mondello Racing Engines in Corona Ca. by Bernard Mondello himself who we are using exclusively for all our head work.

Art was originally running a dual quad low rise Offy intake manifold and after discussing this build with him, it was decided to change to a single four barrel carb configuration so a new Edelbrock Performer RPM “Air Gap” manifold will be used to feed air to this torque monster. The carburetor decision is still pending but most likely will be a Holley vacuum secondary unit in the 700-800cfm range.

The camshaft, considered by many to be the “brain” of a motor, will be a new hydraulic roller cam designed as a retrofit to the older Olds engines that came originally with a flat tappet hydraulic cam. This camshaft is a Howards Cams piece with what sounds like very aggressive specs at .560 / .555 lift and 278 / 282 duration but in this roller profile, will actually behave better on the street than a similar flat tappet spec’d cam would. This cam will also incorporate some new technology in having a 4/7 swap of the firing order. This has become a common approach with the Chevrolet racing engines and what it does is smooth’s out the engine vibration from rough idle associated with long duration / overlap camshafts. This in turn improves throttle response and overall drivability with a racing cam profile.

Compression in this motor will be 9.7 to 1 and is achieved using a forged “Icon” brand dished piston which is the manufacturer of Silvolite and Keith Black brands of pistons. These pistons are both stronger and lighter than the traditional TRW / Sealed Power forged pistons used in many Olds builds which improves durability against detonation while offering a lighter rotating assembly which means more

power to the wheels. The rings being used with these pistons are “low tension” single moly ring sets which means the top compression ring is made of chromemoly steel while the second compression ring is a cast iron piece. These rings are ordered at .005 oversize and we file fit each ring package to each cylinder to “blueprint” the ring end gap measurements for each bore.

All the bearings for this motor are Clevite 77 performance bearings which are pretty much the industry standard for hi-performance builds as well as many race engine combinations. This bearings feature fully grooved main bearing shells, chamfered edges, tri metal composition, and protective coating for proper break in. If you are rebuilding an Olds engine yourself, this is the only bearing package you should be using. The reason for this is all the other available bearing kits for the Olds motors have only half grooved mains which will not adequately provide oil to the main journals on the big block engines.

The timing chain for this build will be the original set up from Art’s other motor as it was almost new with no wear or stretch. It is a Rollmaster brand true double roller chain with steel billet gears and is adjustable to set additional advance or retard into the cam timing.

The oiling system will incorporate a new Melling hi-volume oil pump with extended bolt on pick up to properly fit the 7 quart Moroso deep oil pan we will be using.

Sealing this engine will be accomplished using Cometic MLS (multi-layer steel) head gaskets, special composition intake manifold gaskets with imbedded sealing beads around each intake port, standard timing chain cover gasket, special composition oil pan gaskets, and standard Fel Pro oil filter housing gasket. We do not use the typical rubber end rail seals for the front and rear of the intake manifold as these pieces shrink and crack in time but instead using black RTV to insure this area will stay sealed over the long haul.

In next month’s tech article of this series, we will start covering the assembly process and review some do’s and don’ts when assembling this type of Olds powerplant.

As always, please feel free to contact me if there are any questions.

Grant