.

GROUP 9A ENGINE DISMANTLING

Pre Engine dismantling "Drain engine oil"

1. *Remove sump plug to drain oil & place the sump plug in the dismantling basket until assembly. Do not refit the sump plug as it is the assembler's job to refit & tighten with new sealing washer if required. (do not leave sump plug loose in sump under any circumstances as this is an accident waiting to happen!!!)*
2. *Any components not relating to reconditioning of a long motor must be removed & boxed up ready for dispatch for when the motor is completed with job # & engine type. The motor will now be in the assembled form as it will be when completed. (without any extras)*

Return to top

Engine dismantling

1. *It is the responsibility of the dismantler to inspect & report the parts as they are removed for abnormal wear & damage which may render them unsuitable for reconditioning. It is critical that any component such as sump plugs, oil pump relief valves, etc when dismantled are not then refitted & especially not refitted hand tight.*
2. *Once the cylinder head has been removed, measure the cylinder bores & inspect for cracks or any damage before going any further. If an engine is already on maximum over-size the engine may be rendered useless. (No point in wasting valuable time dismantling & cleaning junk.) Pay special attention to faults & damage. eg. broken studs, broken castings, water marks in cylinders & on blocks (Possible sign of cracks). Report any faults & mark down on the job sheet for repair or replacement.*

3. *Once removed from the hot tank and dried, the main bearing caps must be refitted to the block to avoid any possibility of loss or mix up with another block.*

4. *Parts to be cleaned in the spray wash include: any alloy parts, spark plugs, temp/ pressure switches. ** CAUTION ** Aluminum components MUST NEVER be placed in the hot tank. A chemical reaction will destroy the component and cause the alloy to over-plate on to other parts in the tank.*

Return to top

During engine dismantling the following procedure must be adhered to.

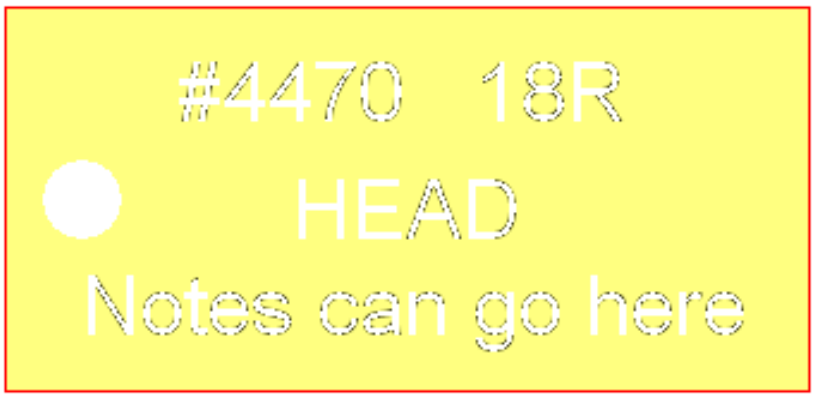
1. *Any components not relating to reconditioning of a long motor must be removed & boxed up ready for dispatch for when the motor is completed with job # & engine type. The motor will now be in the form of a long engine (as it will be when*

reconditioned)

2. As the motor is stripped down, all the bolts & components are to be put in cleaning baskets in sequential order. (1) Head components (2) Sump components (3) Timing components. (The same order as the engine should be dismantled) These 3 types of components must never be mixed together.

3. If there are too many head components for one basket for eg: Name them Head-1, Head-2, Head-3, in the order they where removed, In which case Head-3 would be the first basket to be used in assembly.

4. All baskets are to be tagged with Job #, Engine type & Information required as per sample.



1. To eliminate time & confusion during assembly, do not throw out old parts when removed from engine. Spray wash old parts such as pistons, bearings, timing components, head gasket, & re-usable gaskets & keep together in a separate container with other parts in assembly.

2. When the engine has been assembled, these parts can be recycled or thrown in the scrap heap or returned to the customer at his request.

Return to top

GROUP 9B ENGINE ASSEMBLING

DA3600 Short block assembly.

Cleaning of engine block & crankshaft.

- *Use a solvent such as Kerosene to wash any oil & grease from the parts, while paying attention to cleaning oil galleries using gallery brushes.*
- *The next step is to clean the parts in Soap & water to remove all traces of carbon & other debris that the solvent will not remove.*
- *Finally dry the parts with a blow gun & spray them with CRC or equivalent to prevent them rusting.*

Ø *Squirt some oil into the cylinder bores & wipe with a clean white rag to remove any carbarundom left in the cylinder cross hatch. If the rag comes out clean it is OK, otherwise keep cleaning until the rag shows no sign of grey after cleaning.*

Return to top

Fitting of oil gallery & coolant welch plugs.

Ø *Oil gallery plugs should be fitted using hydraulic sealant such as Loctite 569 to prevent leakage.*

Ø *Cam plugs & Welch plugs must be fitted using a sealant such as 3J Permatex. When fitting Cup type welch plugs, Do not hit the center of the plug. You must use a proper fitting bush that applies the force to the outside edge of the plug & fit until you reach the lower chamfer of the hole.*

Ø *Welch plug interference needs to be .012" - .014" on a 1-5/8" cup plug, if a plug does not feel tight going in measure it.*

Return to top

Assembly of rear main oil seal & crankshaft.

Ø *Neoprene RMB seals must be fitted dry into the housing or engine block & the sealing lip must be coated with assembly lube.*

Ø *Graphite rope RMB seals must be forced into the groove with the help of the ball of a ball peen hammer to sufficiently squeeze the seal into the groove & prevent the seal from burning out due to excessive friction. Once fitted you can trim the ends of the seal with a razor blade allowing the ends to protrude slightly by about .030"& bevel the edges slightly to prevent the seal from getting under the cap when fitted.*

Ø *With the block & main caps clean & dry fit the main bearings, paying attention to oil hole alignment in the block & also the thrust bearing position. (not always at the rear)*

Ø *Apply assembly lube such as Sealed Power 55-400 or Torco MPZ to the bearings, install the crank & fit the main caps. Torque main bearing bolts to specified torque.*

Ø *Check crankshaft end float with a dial indicator & adjust as required by loosening & repositioning the main cap with the thrust bearing & re-tightening. Check the specs for your engine. Typical end float would be in the range of .004" - .012".*

Ø *If you cannot get enough end float remove the thrust bearings & remove the required amount off the front thrust face using 180 wet/dry paper on a flat surface.*

Return to top

Fitting of rings & bearings to piston assemblies.

Ø *Start by checking the ring end gaps in #1 cylinder by placing them in square to the top deck & using a feeler gauge to measure the end gap. As a general rule the top ring requires a minimum gap of .004" per inch of bore. Eg 4.000" X .004"*

= .016". Check instructions supplied with ring set.

- *Fit the rings on the pistons the correct way up & with the end gaps placed as per manufacturers recommendations if available or as per below. The top ring gap should be placed away from the exhaust valve & either to the front or rear. (not toward a thrust face)*
- *Start by fitting the oil ring expander with the end gap toward the ex valve, with the rails 150 degrees away on opposite sides 60 degrees apart.*
- *Fit the second ring end gap directly above the oil ring expander gap, then fit the top ring end gap 180 degrees from the second ring. This will end up with the top ring opposite the exhaust valve being the coolest part of the cylinder.*
- *The next step is to fit the bearings to the con-rods, with the con-rods & caps clean & dry fit the bearings, paying attention to any oil hole alignment.*
- *Note: Con-rod bearings for stroker cranks that are machined for clearance are machined in pairs & must have the machined side toward the crank radius. Eg: Holden 330*
- *Squirt a small amount of oil on both thrust surfaces of the cylinder bore & on the piston thrust faces.*
- *Apply engine assembly lube such as Sealed Power 55-400 or Torco MPZ to the bearings & fit nylon or plastic tubing to the rod bolts to prevent any damage to the crankshaft on installation.*
- *Using a suitable ring compressor such as Lisle wrinkle band or better still a tapered ring compressor, gently but swiftly tap the piston into the cylinder bore with a soft rubber or wooden hammer handle.*
- *Carefully tap all the way in until the bearing seats in the crankshaft journal, then check that the bearing has not moved & re-position if required.*
- *Fit the cap the correct way around & apply oil or moly (ARP bolts) to the threads before tensioning to the correct torque or stretch method as required.*
- *Repeat fitting to all cylinders & as a precaution double check you have not fitted a piston backwards. If at any stage the engine does not turn freely go back & double check your work until you find the reason why.*
- *The last thing to do is check the end float or side clearance on your con rods, check the specs for your engine. A typical in-line car engine will be aprox .004"-.012" & V6 or V8 aprox .010"-.020".*
- *After assembling the short block rotate the engine while checking for clearance & binding of any components for trouble free performance.*

Return to top

Fitting camshaft & degreeing cam timing as per cam card.

- *Apply assembly lube to the camshaft journals & carefully install the cam in the block*

& check that cam will rotate freely.

- Ø *Assemble the timing components as required & set up on standard timing marks. (be careful not to leave out any shims etc)*
- Ø *Find true TDC by placing a dial gauge in the centre of #1 piston.*
- Ø *Using a solid lifter preferably in #1 inlet, set up a dial indicator & zero on the back of the cam lobe.*
- Ø *Rotate the engine & check inlet lobe lift @ TDC. Compare to the cam card & adjust if required.*

Return to top

Fitting head studs in block.

- Ø *Check threads in block for debris & damage, clean out with a "cleaning tap" as required or replace with a recoil. Check to make that no metal is being removed with thread "cleaning tap".*
- Ø *When head studs or bolts go into water use GM sealant or 3J Permatex to seal the threads, never use ARP Teflon sealant as it does not seal water & will cause an engine failure.*

SETTING UP TRUE T.D.C. Top Dead Centre

- Ø *Place a magnetic dial gauge on the top of the block & locate the dial gauge on the piston centerline to eliminate errors due to piston rock at TDC.*
- Ø *Turn the crank until the dial gauge indicates TDC & set up the degree wheel & pointer to indicate zero.*
- Ø *Continue to rotate engine clockwise one full cycle until .010" short of TDC & read crank angle. Eg: .006 BTDC*
- Ø *Next rotate it through TDC until it's .010" down the cylinder & read crank angle. EG: .004 ATDC*
- Ø *The two figures should be an even amount either side of TDC. If not move the pointer in the direction of the highest number & re-check until true TDC is achieved.*

Return to top

CAM TIMING Set-up procedure To be done at completion of short block.

Method - 1 Using the inlet lift @ TDC method on your cam card.

A quick & easy way of setting up a cam is to check #1-inlet cam lift @ TDC on the overlap providing this information is available on your cam card.

- Ø *Find true TDC by placing a dial gauge in the centre of #1 piston using the averaging method.*
- Ø *Using a solid lifter in #1 inlet, set up a dial indicator & zero on the back of the cam*

lobe.

- *Ø Rotate engine & check inlet lobe lift @ TDC. Compare to cam card & adjust if required.*

Method - 2 Using the lobe center-line method as used on your cam card. Preferred.
This method sets the full lift point on the #1 inlet to a specified position of crank rotation after TDC on the intake stroke. Usually between 102-112 degrees after TDC.

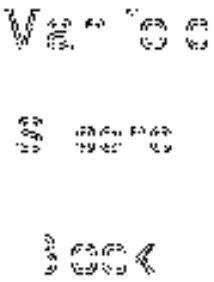
- *Ø Find true TDC by placing a dial gauge in the centre of #1 piston & setting up a degree wheel & pointer mounted on the rear of the crank. The reason for using the rear of the crank is to allow cam timing changes & ability to check the timing marks on the balancer at a later time.*
- *Ø Using a solid lifter in #1 inlet, set up a dial indicator & zero on the back of the cam lobe.*
- *Ø Rotate engine until it reaches full lift & read. As an example we will use .350" lift.*
- *Ø Continue to rotate engine clockwise one full cycle until .340" lift (.010" short of full lift) & read crank angle. Eg:91 degrees ATDC*
- *Ø Continue to rotate engine clockwise over max lift & back down to .340" lift & read crank angle. Eg:122 degrees ATDC*
- *Ø By averaging both points (91/122) we can see that full lift occurs at 106.5 degrees. Compare to cam card & adjust if required.*

Valve lash
When setting the valve lash on any hydraulic cam with solid lifters use .008" on the inlet & exhaust to allow for the quietening ramps.
Return to top

Assembly of V8 manifold to engine.

- *Ø Fit manifold gaskets to head faces & test fit manifold to check bolt hole alignment & also the gap at each end of manifold.*
- *Ø If there is a problem with this alignment the manifold will need to be machined, otherwise measure the gap at each end & remove the manifold.*
- *Ø Apply a smear of silicone around the head face water ports & fit the gaskets.*
- *Ø Smear a film of silicone to the manifold & block faces at the front & rear to create a primer & then apply a bead of silicone to each end that is aprox 2mm higher than the measured gap.*
- *Ø Fit manifold & bolt down.*

.



Return to top

GROUP 9C ENGINE CLEARANCES

CLEARANCES TO BE CHECKED ON RACING ENGINES

MOCK-UP OF ROTATING ASSEMBLY.

Always check rotating assembly's clearance in block prior to crankshaft balancing. Check bearings for clearances on radii's at this time also. (Cranks with large radii may require chamfered bearings)

At time of mock-up all pistons and rods must be assembled and installed in block along with crank to begin checking of component clearances. The camshaft must also be installed and timed to the crank at this stage.

ITEMS TO INSPECT (ROTATING ASSEMBLY) MINIMUM .040" AT ALL POINTS

Clearance between crankshaft and block.
Clearance between pistons and crankshaft counterweights.
Clearance between rods and block.
Clearance between rods and camshaft lobes.
Clearance between crankshaft and oil pan.
Clearance between crankshaft and oil pump.

Return to top

PISTON TO VALVE CLEARANCE

Normally aspirated engines.

Piston to valve clearance to be no less than .080" on inlet and no less than .090" on exhaust. (Preferably .100" Inlet & .120" Exhaust.)

Supercharged & turbocharged engines.

Piston to valve clearance to be no less than .110" on inlet and no less than .160" on exhaust.

(Preferably .130” Inlet & .180” Exhaust.)

Caution. Check piston to valve clearance after the valve timing has been set up.
Advancing the cam by 5 degrees will reduce Inlet valve clearance by approximately .030”.
Retarding the cam by 5 degrees will reduce Exhaust valve clearance by approximately .030”.

When fly cutting pistons, allow an extra .080” on radius to allow for piston rock and valve stem movement.

Return to top

PISTON TO CYLINDER HEAD CLEARANCE
For steel con-rods .040”-.050” minimum and .060” maximum.
For aluminum con-rods .055”-.060” minimum and .070” maximum.

Return to top