



# **SUGGESTED INSTALLATION PROCEDURES AND INSTRUCTIONS FOR GASOLINE ENGINES**

## **TO INSTALLING MECHANIC OR TECHNICIAN**

This engine has been carefully remanufactured to precision standards. It will perform properly IF certain steps are taken by the person making the installation.

An engine is a complex component that requires the highest degree of technical knowledge to install. It is recommended that you, the installer, have an ASE certificate or the equivalent before you accept the RESPONSIBILITY of properly installing an engine.

When a properly remanufactured engine fails to give satisfactory service, it can be due to detonation, pre-ignition or "lugging," overheating or excessively rich air-fuel ratio, under-lubrication, dirt, coolant seepage, ineffective air filtering. The above mentioned reasons for failure are the responsibility, and under the control, of the installing mechanic/technician not the engine rebuilder.

**CAUTION, these recommended installation procedures and instructions are a partial list intended only as a guide. If you are not qualified to undertake this installation, do not attempt it as you may be liable for resulting engine failure.**

Replacing all of the following with new or rebuilt/remanufactured units is recommended: valve lifters, oil pump, push rods, rocker arms, oil pump screen with new screen, spark plugs, points (if applicable), condenser, motor mounts, oil filter, air filters, water pump, thermostats, PCV valve & grommets and clean lines (Note: A plugged line or faulty valve may cause excessive oil consumption and blowby), carburetor (may be rebuilt) and make sure the EGR valve is operating to OEM specifications.

Follow the manufacturer's installation procedures; especially proper torque values. Inspect the rocker cover baffle for possible restrictions.

Contamination is an engine's worst enemy. We recommend that you thoroughly clean parts that will be attached to the rebuilt/remanufactured engine.

Any and all parts not included with a remanufactured engine or engine component should be cleaned properly before installing on a new remanufactured engine.

## **INSPECTION OF ENGINE PRIOR TO INSTALLATION**

- Check for freight damage and dirt contamination of the engine.
- Check for proper valve train timing.
- Check that ALL oil gallery plugs are installed, tight and sealed.
- Check that ALL freeze plugs are installed and sealed.
- Check that temperature recording labels or heat tabs on the block and the heads are installed.
- Check application of product - make sure the mounting holes, bell housing, crank shaft snout, flywheel mounting flange, bolt hole patterns, pilot shaft hole, smog/non-smog application, etc., are the same on new product as the old by comparing casting numbers.
- Clean all accessories to be transferred to the new product, from the old one. Resurfacing of the intake manifold and machine gasket surfaces is required.

## **TIMING COVERS**

- Inspect for erosion, breakage, warpage, porosity and abnormal wear patterns.
- Measure covers containing oil pump for wear and replace if not within OE tolerances.
- Install new timing chain tensioners, dampners, etc.

## **VALVE LIFTERS - Flat, Roller, HLC (Hydraulic Lash Compensators)**

- Install new lifters and inspect push rods on short blocks to avoid camshaft wear and premature failure.
- Pre-lube cam & lifters with extreme pressure lube.
- Do not preload lifters (it causes undo stress to camshaft and lifters which may lead to early failure).
- Lifter rattle at cold start is not uncommon, and does not cause engine damage.
- Roller Lifters may be reused if within OE specs.
- Hydraulic Lash Compensators (HLC) are generally reusable, but may need to be purged of all air.

## **DRIVE PULLEY (Harmonic Balancer)**

- Check seal surface of pulley hub and repair or replace if grooved or damaged (harmonic balancer seal surface wear sleeves may be available).
- Lubricate seal surface prior to installation to prevent damage to seal.
- Check outer ring for slippage as this could cause "O" timing mark to not indicate top dead center.
- Replace balancers set in rubber. (The interior rubber deteriorates with age, allowing the balancer to slip, possibly causing timing problems and detonation, overheating, vibration and unexplained noises).

## **CYLINDER HEAD TORQUE**

- Properly torque cylinder head at installation to OE specifications in the correct sequence. (Use new bolts when OE requires).

## **VALVE LASH**

- Consult shop service manual for dry lash setting for nonadjustable rocker arms.
- Check dry lash at time of installation (if applicable).
- Check and adjust lash at 500 miles (if applicable).

## **INTAKE MANIFOLD MUST BE CLEANED**

- Clean off carbon (remove steel heat shield, if equipped, clean and reinstall).
- Magnetic particle inspect or die check for cracks.
- Blow out with compressed air to avoid having foreign material enter combustion chamber.
- Remove baffle (where applicable) so that all collected contaminants can be removed.
- All EGR passages must be cleaned and free of obstruction.
- Do not over torque manifold bolts. Use OE torque specifications and sequence ONLY.
- Do not glass bead intake manifolds to clean.
- Check water outlet for corrosion.

## **ROCKER ARM ASSEMBLIES**

- Check for wear and replace if necessary (remanufactured units are available).
- Confirm proper shaft installation as some can be installed upside down. Excessive oil consumption may result.

## **DISTRIBUTOR**

- Check bushing, mechanical advance, vacuum advance, and total advance.
- Check to see that distributor is fully engaged and locked in the oil pump to proper depth.
- Adjust ignition timing to factory specifications.
- Check distributor drive gear for wear and replace as needed.

## **FUEL SYSTEM**

- Carefully service or replace all aspects of the fuel system, i.e. pump, lines, carburetor or fuel injection components.
- Check fuel lines for breaks and crimps. Use only approved steel lines.
- Check fuel pump for proper pressure.
- Check double diaphragm type for faulty vacuum booster which may pump oil through the intake system.

## **FILTERS**

- Replace all filters at time of installation and at O.E. recommended intervals. These filters include air, oil, fuel, and crankcase.
- Use cleaning procedure outlined previously above to clean air cleaner housing, crankcase vent tubes coolers, air compressors, Donaldson valves, etc.

## **THRUST BEARING**

- Adjust clutch to proper free pedal BEFORE starting engine, NOT after.
- Check crankshaft end thrust before and after bolting transmission to engine.

PLEASE NOTE!!! - excessive main bearing thrust wear may be caused by the following:

1. clutch not adjusted properly
2. interference between pilot shaft and crankshaft
3. interference between torque converter & crankshaft
4. torque converter ballooning
5. blockage and/or restriction of transmission oil cooler
6. bent, kinked, or damaged supply lines
7. incorrect crankshaft end thrust

**Preventing the causes of thrust bearing failure is the responsibility of the installing technician!**

## **RADIATOR/COOLING SYSTEM**

- Recore or replace the radiator and test flow.
- Verify thermal conductivity. Minimum of 25°F temperature differential between inlet and exhaust.
- Always replace pressure cap and thermostat.
- Check temperature sending unit fan switch.

## **HEAT RISER OR EXHAUST THERMOSTAT CONTROL**

- Check to see if unit is free and operating properly.
- Lubricate with special high heat formula.
- Make sure hot air door operates freely on air cleaner.

## **OIL SYSTEM**

- Fill to proper level.
- Use only OE specified lubricants or equivalent to full levels before operation.
- Use a pressure tank at about 40 pounds pressure to prime (pre-lube) engine as this will insure vital parts are lubricated properly to avoid a dry start. (Spinning of the oil pump to accomplish this is not recommended).
- If pressure tank is unavailable, use an aftermarket assembly lubricator kit for prelubing of system before initial fire up (follow recommended procedures). Call for further information.
- Install new oil pump and pickup screen. Install new oil filter filled with new oil prior to installation.
- Check oil pump intermediate shaft for correct size and shape to match distributor and oil pump, if applicable.
- Oil pump may need to be primed before starting. (Run at 800 rpm at intervals before releasing to customer for use to assure proper cylinder lubrication.)
- Replace oil pressure sending unit.

## **RUBBER GOODS**

- Don't overlook small parts such as belts, hoses (those that carry liquids and air) and motor mounts which become weak and worn with age. We suggest that these items be replaced at time of engine replacement.

## **ACCESSORIES**

- Be sure to service and inspect accessories such as alternator, starter, water pump, air compressor, fuel system, EGR valves and all sensors to avoid premature engine failure.

## **FLYWHEEL**

- On engines that use a 1-piece full circle rear main seal and flangeless flywheel mounting system, over torque of the flywheel bolts may distort the rear seal area and cause an oil leak.

## **ENGINE START-UP**

- Check oil pressure.
- Engine should start, excessive cranking may be present.
- Check for oil and water leaks.
- Install radiator cap after coolant is observed to be circulating (some thermostats air lock and prevent proper circulation of coolant).

## **MODULATOR VALVE (located on automatic transmission)**

- Pull off lines, if valve is defective, oil may be present.
- Replace if above condition is observed, as it may allow transmission fluid to enter engine through vacuum system and prevent proper ring seal.

## **EXHAUST MANIFOLD PRESSURE & SYSTEM**

- Replace oxygen sensor with a low pressure gauge.
- Run engine at 2500 RPM for 1 minute.
- High pressure reading should be less than 2.5 pounds.
- A pressure reading over 2.5 pounds indicates an exhaust system restrictions which will cause engine damage. Check catalytic converters and exhaust systems for restrictions.
- Inspect exhaust manifold for internal and external cracks, especially on marine applications.

## **ENGINE ANALYSIS**

- Make an engine analysis data sheet (either a diagnostic printout or handwritten form) showing the status of the engine and the Engine Support System before installation, after installation and at the 500 mile checkup.
- Check engine or service engine soon lights (computer-control problems).
- Check for any trouble codes, this may be a clue to why the engine previously failed.
- Check for correct vacuum hose routing and for vacuum leaks.

- Replace distributor, wiring, coil, and spark plugs to avoid poor performance. On V-8's, check plug routing.
- Final road test vehicle, do not return to customer unless you consider vehicle operating according to OE specifications
- Give customer printout of exhaust gas analysis.

On computerized emission control systems, check the following items that are applicable:

- Load sensors
- M.A.P.
- V.A.C.
- BARO
- Throttle position sensor (TIS)
- Stepper motor
- Mixture control solenoid
- Incorrect PROM (on GM cars)
- Catalytic Converter Sensor
- EGO sensor
- EGR flow sensor
- Airflow sensor
- Coolant temperature sensor
- Crankshaft position sensor
- Engine RPM sensor
- Electronic spark controls
- Idle speed control (ISC)
- Air temperature sensor
- Air conditioning sensor (switch)
- Knock sensor
- Halleffect switch
- Turbo boost limiting system (wastegate)
- Torque converter clutch
- Road Speed sensor
- Oil and temperature sending Unit/gauges \*

\* The failure of some of these sensors can result in abnormal combustion temperatures and pressures, blown head gaskets, burnt pistons, piston scuffing and burnt valves, bearing failure and lack of power and may result in eventual engine failure.

--

### **AERA – Engine Builders Association**

330 Lexington Drive  
Buffalo Grove, IL 60089-6998  
U.S.A.

The purpose of the Association is to develop and encourage high standards of workmanship and ethics among its members; to improve business conditions through the exchange of information and ideas; and to promote the common business interests of persons and organizations engaged in the remanufacturing of internal combustion engines or basic internal components of such engines in automotive machine shops.

For membership information, please call 847-541-6550  
[www.aera.org](http://www.aera.org) • e-mail [info@aera.org](mailto:info@aera.org)

This information is provided from the best available sources, however, AERA does not assume responsibility for data accuracy or consequences of its applications. Please be aware that this pamphlet is not a warranty.