



# SUGGESTED INSTALLATION PROCEDURES AND INSTRUCTIONS FOR DIESEL ENGINES

## TO INSTALLING MECHANIC OR TECHNICIAN

This engine has been carefully remanufactured to precision standards, and 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, or an ADS 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 abnormal combustion or "lugging", overheating, excessively rich air-fuel ratio, under-lubrication, dirt, coolant seepage, or ineffective air filtering. The above mentioned reasons for failure are the responsibility, and are 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, motor mounts, oil filter, air filters, water pump, thermostats, crankcase ventilation system, clean lines (Note: A plugged line or faulty assembly may cause excessive oil consumption), remanufactured or new fuel system components, new or remanufactured Oil-Cooler when applicable, remanufactured, turbocharger, and the supercharger intercooler.

Insure the EGR valve is operating to O.E.M specifications. (if applicable)

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 the 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 and fuel injection timing.
- Check that ALL oil gallery plugs are installed, tightened 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 and mounting holes.
- Replace with new or remanufactured accessories to be transferred to the new product, from the old one. Resurfacing of the intake manifold and machine gasket surfaces is required.

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

- Install new lifters or remanufactured lifter assemblies and inspect push rods on short blocks to avoid camshaft wear and premature failure.
- Do not preload hydraulic lifters (it causes undo stress to camshaft and lifters which may lead to early failure).
- Hydraulic lifter rattle at cold start is not uncommon, and does not cause engine damage.
- Roller lifters may be reused if within O.E. specifications.
- Hydraulic Lash Compensators (HLC) are generally reusable, but may need to be cleaned and purged of all air.

### **TIMING COVERS**

- Inspect for erosion, breakage, warpage, porosity and abnormal wear patterns.
- Measure covers containing oil pump for wear and replace if not within O.E. tolerances.
- Install new timing chain tensioners, dampeners, etc. when applicable. Idler gear assemblies require inspection for wear and reusability.
- cylinder head torque
- Properly torque cylinder head at installation to O.E. specifications in the correct sequence. (Use new bolts when O.E. requires them).

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

- 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).

- Viscous dampers require inspection and/or testing based upon O.E. mileage/hour limits. Must be replaced when initial engine had catastrophic failure.

### **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 O.E. torque specifications and sequence ONLY.
- Do not glass bead intake manifolds to clean.
- Check water outlet for corrosion.
- Disassemble and reseal intake manifold sections.

### **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).
- Verify crossover bridge balance (if applicable).

### **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.

### **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.

### **FILTERS**

- Replace all filters at time of installation and at O.E. recommended intervals. These filters include air, oil, fuel, and crankcase.
- Clean air cleaner housing, crankcase vent tubes coolers, air compressors, Donaldson valves, etc.

### **RADIATOR/COOLING SYSTEM**

- Recore or replace the radiator and test flow.
- Verify thermal conductivity. Minimum of 35°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 O.E. 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/remanufactured 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 (if applicable).
- Replace oil pressure sending unit.
- Replace oil cooler if catastrophic failure, pressure test and reseal bundle within assembly.

### **THRUST BEARING**

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

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

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

- clutch not adjusted properly
- interference between pilot shaft and crankshaft
- interference between torque converter & crankshaft
- torque converter ballooning
- blockage and/or restriction of transmission oil cooler
- bent, kinked, or damaged supply lines
- incorrect crankshaft end thrust

### **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**

- Install bolts with sealer or replace as required.
- On engines that use a 1-piece full circle rear main seal and flangeless flywheel mounting system, over torque of the fly wheel bolts may distort the rear seal area and cause an oil leak.
- Verify clearance between flywheel and seal housing.

## **ENGINE START-UP**

- Do not under any circumstances use starting fluid.
- Engine should start, excessive cranking may be present.
- Check oil pressure.
- 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 (if applicable; 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 restriction 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.
- Road test the vehicle, do not return to customer unless you consider the vehicle operating according to O.E. specifications.

## **ENGINE ANALYSIS**

### **OIL PRESSURE**

- Observe oil pressure reading immediately after starting the engine. If there is no oil pressure within 10-15 seconds, stop engine and check lubricating oiling system. Once recommended engine break-in period is concluded, oil sampling should be done to verify no premature or abnormal component wear occurrence.

## RUN IN

- Run engine at part throttle and at no-load until it reaches operating temperature prior to applying any load.

## INSPECTION

- With engine running at operating temperature, check for coolant, fuel or lubricating oil leaks.

## COOLING SYSTEM

- Verify that cooling system has reached operating temperature and circulated effectively and that the level is correct.
- Avoid unnecessary idling periods, engine coolant temperature will fall below normal operating temperature range. Once normal cooling system operation has been verified appropriate coolant conditioner should be introduced to avoid cavitation and electrolysis.

## TURBOCHARGER (if applicable)

- Visual inspection of leaks and possible vibrations should be observed. If there is any unusual noise STOP engine immediately.

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.

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**AERA – Engine Builders Association**

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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.

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