

# ENGINE FITTING PROCEDURES

## Code of practice for reconditioning COMPRESSION IGNITION ENGINES

### APPENDIX A ENGINE REMOVAL AND FITTING (Normative)

#### A1 GENERAL

This Appendix specifies minimum activities that shall be performed at the time of the removal and refitting of the engine.

This Appendix also ensures that the newly-fitted engine does not suffer from failure or damage as a result of improper diagnosis of the original fault, improper fitting, or failure to correct a fault in an ancillary component or system.

The removal and refitting shall be carried out or supervised by a suitably qualified person.

#### A2 PRELIMINARY TESTING

Prior to commencement or removal of the engine, its number, vehicle registration and its odometer or hourmeter reading shall be recorded and the cause of its failure shall be diagnosed in order that the cause, if related to failure of a component or system external to the engine, is corrected. This is essential to prevent failure of the replacement engine. This diagnosis may involve either road or static testing, examination of critical components, e.g. radiator, hoses, fuel system, water pump, thermostat, oil filter, air intake system, air compressor, turbocharger and related plumbing, and advance mechanisms, external oil lines, glow plugs, wiring, and the crankcase ventilation system.

#### A3 ENGINE INSTALLATION

It is the responsibility of the repairer to ensure that the engine being refitted is the correct type and specification for the vehicle **and is free from visual damage i.e. transport damage**. The method of fitting the engine to the vehicle shall be in accordance with the relevant manufacturer's recommended procedure. **Note:** All engines should be started and run to operating temperature on water prior to adding coolant. Check all external nuts & bolts for tightness.

#### A4 ENGINE OIL

The grade and specification of engine oil used during the running-in period shall be as specified by the engine manufacturer unless otherwise recommended by the reconditioner.

#### A5 INSTALLATION CHECK

Upon start-up, installation shall be checked as follows:

- A. The fuel injection system shall be checked for correct adjustment and operation. This check shall include timing and injector pump advance calibration, including correct operation of advance mechanism.
- B. Oil pressure shall be checked, and any leaks (oil, water, air or fuel), abnormal noises, rattles or vibrations shall be investigated.
- C. After initial warm up, cylinder heads shall be retensioned by releasing bolt load, relubricating under the head and retightening to the correct torque or angular movement in accordance with the **re**-manufacturer's procedure. Aluminium heads shall be retensioned cold, or hot where specified by the engine **re**-manufacturer **if applicable**.
- D. Tappet clearances shall be checked and adjusted as required.
- E. Crankcase breathing system and crankcase ventilation valves shall be checked to ensure cleanliness and correct operation.
- F. A road test of not less than five kilometres shall be conducted prior to the release of the vehicle.

**APPENDIX B**  
**ENGINE PERFORMANCE CHECKS (Normative)**

**B1 GENERAL**

This Appendix defines additional checks to ensure the correct operation of items that could affect engine performance, i.e. cooling, electrical and fuel systems.

**Note:** Petrol Note

**B2 COOLING SYSTEM**

Cooling system deterioration may have occurred during the life of the old engine. The new engine will require that the cooling system efficiency is checked and restored to its original condition and rectified, if required, as follows:

- A. *Radiator Tanks* shall be removed and the tubes cleaned out. The core shall be replaced if thorough cleaning is not possible or if corrosion has occurred on the fins, or if the fins are bent, or if the airflow passage through the fins is blocked.
- B. *Heater core* Water flow shall be checked and loose scale removed.
- C. *Hoses* All hoses shall be checked for splits, evidence of perishing (soft areas), presence of a collapsed spring (bottom suction hose) and condition at the ends where clamping occurs. New hoses shall be fitted unless the old are verified to be totally free of such faults.
- D. *Water pumps* Water pumps shall have seals and bearings checked and replaced as required and impeller blades checked for corrosion or breakage. New pumps shall be fitted unless the seals and blades are verified to be free of such faults.
- E. *Fan blade, pulleys* Fan blades shall be inspected for cracks, missing, bent or damaged blades and replaced if such faults are evident. Pulleys shall be replaced if worn.
- F. *Fan/water pump drive belts* shall be replaced with new items, if required.
- G. *Water temperature gauge warning device* The device shall be working in accordance with manufacturer's specifications.
- H. *Thermostat* The thermostat shall be checked for correct operation or renewed.
- I. \* *Engine coolant* The system shall be filled with distilled or demineralized or soft water, and correctly bled (with heater circuit open), with inhibitor/coolant suitable For cast iron or aluminium alloy applications complying with the appropriate Standard.  
**\* coolant is to be added at manufacturers recommendation and in accordance with standards.**
- J. *The cooling system* The cooling system shall be pressure tested to at least 20 kPa over cap release pressure, and the cap pressure shall also be tested. In addition, the operation of the cap's vacuum valve shall be checked.
- K. *Electronic engine management system* The system shall be checked with appropriate diagnostic equipment to ensure operation is in line with manufacturer's specifications.

**B3 INDUCTION SYSTEM**

The induction system shall be checked for presence of dust or foreign material-

- A. from the air inlet of the filter; and
- B. from the inlet manifold to the valve seat.

In addition -

- i. in instances where an inlet manifold has a joint face or chamber connecting to the crankcase these shall be thoroughly cleaned; and
- ii. a new air filter element shall be installed, and all connections and gaskets shall be checked to ensure they are airtight and dustproof.

## **B4 FUEL SYSTEM OPERATION**

Fuel system operation shall be checked as follows:

- A. The fuel pump, injectors and fuel lines shall be verified to have been tested in accordance with manufacturer's specifications and if required dismantled, cleaned, reconditioned and tested in accordance with the manufacturer's specifications. This work must have been performed by a qualified diesel fuel system technician.
- B. The lift pump shall be tested in accordance with manufacturer's instructions and reconditioned where necessary.
- C. Checks shall be carried out to verify correct timing and also the correct operation of the advance mechanism (whether integral with the pump or part of the camshaft or auxiliary drive assembly).
- D. Glow plug operation shall be checked.
- E. Fuel cut-off switches and associated wiring shall be checked.
- F. Primary and secondary filters shall be replaced, and water traps (if any) shall be cleaned.

## **B5 LUBRICATION SYSTEM**

The lubrication systems shall be checked as follows:

- A. External oil cooler and lines and hoses shall be thoroughly cleaned. Units which cannot be dismantled for cleaning shall be replaced.
- B. **New filters shall be fitted prior to assembly.**
- C. The engine oil system shall be pressure primed so as to achieve oil pressure, circulation and lubrication of all moving components prior to engine start-up.

## **B6 GENERAL ASSEMBLY**

General assembly check procedure shall include the following:

- A. Crankshaft torsional vibration dampers (if not included already on the long engine assembly) shall be inspected for wear, rubber condition, fastenings and locations or grooves in the seal area, inside diameter being within manufacturer's specifications and outside diameter alignment being correct and not distorted or out of round. The correct location of timing marks relative to keyways shall be verified.
- B. Outside surfaces of viscous dampers shall be checked for condition, diameter, radial thickness and concentricity in relation to manufacturer's specifications.
- C. An on-road installation running check shall be conducted to ensure that the outside casing of viscous dampers reaches approximately engine operating temperature after 20 minutes operation.
- D. Bolts and studs shall be refitted in correct positions, and shall be of the same length and thread as those removed.

In addition, the following checks can be undertaken:

- i. The inlet manifold should be internally cleaned and checked for both distortion of the mounting face and corrosion
- ii. Flywheel and flexplate bolts should be inspected to ensure correct thread, and should be tensioned to manufacturer's specifications. All locating dowels **must** be installed. In instances where holes are open to the crankcase, bolts should be assembled with thread sealant. The clutch should be inspected for wear and replaced if required, and the clutch spigot bush or bearings should be replaced.
- iii. The exhaust system should be checked for flow, leakage and condition. The exhaust brake valve (where fitted) should be set and should operate to manufacturer's specifications.
- iv. Engine mountings should be renewed if there are any signs of rubber deterioration, perishing, softening, oil soaking or if the fastening holes are elongated.
- v. Correct function of oil pressure gauge and warning light should be verified.
- vi. Correct function of water and oil temperature and over temperature warning lights should be verified.
- vii. Correct functions of turbocharger, boost pressure gauge and lubricant supply should be verified.
- viii. Correct function of auxiliaries (e.g. compressor, alternator) should be verified.

**B7 SERVICE**

First and subsequent services shall be carried out in accordance with the engine manufacturer's specifications unless otherwise recommended by the reconditioner.

**B8 RUNNING-IN PROCEDURE**

It is the responsibility of the engine fitter to ensure that the customer/owner is advised of any specific running-in procedures which may accompany or be part of the warranty or which are recommended by the supplier of the relevant replacement components.