

ENGINE FITTING PROCEDURES

Code of practice for reconditioning SPARK IGNITION ENGINES

APPENDIX A ENGINE REMOVAL AND FITTING (Normative)

A1 SCOPE

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

This Appendix also ensures that the newly-fitted engine does not suffer from 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.

NOTE: it is important that the removal and refitting is supervised by a suitably qualified person.

A2 PRELIMINARY TESTING

Prior to commencing removal of the engine, its number, vehicle registration, odometer reading and the following data shall be recorded:

- A. The cause of its failure shall be diagnosed in order that it is corrected, if related to failure of a component or system external to the engine. This is essential to prevent failure of the replacement engine. This diagnosis may involve either road or static testing or examination of critical components, e.g. radiator, fan operation, hoses, fuel and ignition system, water pump, Thermostat, oil filter or air intake system.
- B. All wiring, breathing and emission control vacuum hoses and connections shall be marked to ensure correct reconnection.

A3 ENGINE INSTALLATION

It is the responsibility of the repairer to ensure that the engine being refitted is of 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 must 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 and bolts for tightness.

A4 ENGINE OIL

The reconditioner shall recommend the grade and specification of the engine oil to be used during the running-in period.

A5 INSTALLATION CHECK

Upon startup, the installation shall be checked for the following:

- A. Oil pressure, leaks (oil, water, air or fuel), noises, rattles and vibrations.
- B. Fuel and ignition systems or engine management system shall be cleaned and checked for correct adjustment and operation.
- C. * After initial warm up cylinder heads are to be retorqued to the specifications as laid down by the remanufacturer. (See Notes 1 and 2 below.)
- D. Crankcase breathing system including related emission control components and crankcase's ventilation valves shall be checked to ensure cleanliness and correct operation.
- E. A road test of not less than five kilometres shall be conducted prior to release of the vehicle.
- F. * Retorque shall be carried out by releasing the bolt load and by retightening to the correct torque and angular movement.

NOTES:

1. Retorque may be deleted if the engine is fitted with a cylinder head gasket of single torque construction, as identified by instruction from the engine reconditioner.
2. Valve clearances are to be reset if applicable.
* **Should be as A5c**

APPENDIX B VEHICLE PERFORMANCE CHECKS (Informative)

B1 SCOPE

This Appendix recommends additional activities to ensure correct operation of items which could affect general vehicle engine performance and should be checked, e.g. transmission, brakes, clutch and cooling, electrical and fuel systems.

B2 ANCILLARY COMPONENTS AND SYSTEMS

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 necessary, as follows:

- A. Radiator tanks - These should be removed and the tubes cleaned out. The core will be replaced if thorough cleaning is not possible or if corrosion has occurred on the fins or if the fins are bent or the airflow passage through the fins is blocked.
NOTE: The original air flow through the radiator shall not be obstructed or changed (e.g. air conditioning condenser, bull bars and driving lights).
- B. Heater core Water flow should be checked and loose scale removed.
- C. All hoses should be checked for splits, evidence of perishing (soft areas), presence of anti-collapse springs (bottom hose) and condition at the ends where clamping occurs. New hoses will be fitted unless the old are verified to be totally free of such faults.
- D. Water pumps should have seals and bearings checked and replaced as required and impeller blades checked for corrosion or breakage. New pumps should be fitted unless all of the above are verified to be free of such faults.
- E. Fan blade and pulleys. Fan blades should be inspected for cracks, missing, bent or damaged blades and replaced if such faults are evident. Pulleys should be replaced if worn.
- F. Pump drive belts and auxiliary drive belts. These should be replaced with new items, if required.
- G. The water temperature gauge warning device and fan thermostatic switch if present, must be working in accordance with manufacturer's specifications.
- H. Thermostat. This should be checked for correct operating temperature rating or renewed.
- I. Engine coolant. The system should be filled, and correctly bled, with inhibitor/coolant suitable for cast iron or aluminium alloy applications for the relevant engine type
- J. The cooling system. The cooling system should be pressure-tested to at least 20 kPa over cap release pressure, and the cap pressure must also be tested. In addition the operation of the cap's vacuum valve should be checked.

B3 ELECTRICAL SYSTEM

The electrical system should be checked for the following -

- A. condition of the distributor bearings;
- B. mechanical and vacuum advance mechanism to determine whether they are operating correctly and are of the correct specification for the engine type and fuel e.g. gas.
- C. the contact points, rotor button, cap and high tension leads to determine whether they are in good condition;
- D. upon assembly the distributor engagement with ancillaries (such as oil pump) should be checked with specific attention being made on length of drive spindles (where fitted) and full drive engagement;
- E. ignition timing should be set according to manufacturer's specifications;

- F. new spark plugs if required, of correct heat range for the application are fitted and gapped correctly; and
- G. engine management system should be checked with appropriate diagnostic equipment to ensure operation in line with manufacturer's specifications.

B4 FUEL AND INDUCTION SYSTEM

This should be checked as follows:

Please note all sections must relate to appropriate fuel application.

- A. for the presence of dust or foreign material between the air inlet to valve seat;
- B. where an inlet manifold has a joint face or chamber connecting to the crankcase, the faces must be cleaned thoroughly and checked for straightness and alignment;
- C. after a new air filter element is installed, all connections and gaskets should be checked to ensure they are airtight and dustproof; and
- D. engines with electronic fuel injection systems should have their injectors removed, cleaned, tested and renewed, if necessary.

B5 LUBRICATION SYSTEM

This should be checked as follows:

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

B6 GENERAL ASSEMBLY

This procedure should include the following:

- A. Crankshaft torsional vibration dampers (sometimes referred to as harmonic balancers) should be inspected for wear or grooves at seal area. The inside diameter should be within manufacturer's specifications and the outside diameter alignment should run true and not be distorted or out of round. The correct location of timing marks relative to keyways should be verified.
- B. Bolts and studs should be refitted in correct positions, the same length and thread as those specified by the original manufacturer (e.g. incorrect water pump bolts on certain six cylinder engines will cause cylinder bore distortion).
- C. The inlet manifold should be internally cleaned and checked for both distortion of the mounting face and corrosion. Correct operation of manifold heat riser valve (if applicable) should be checked.
- D. Flywheel and flexplate bolts should be inspected to ensure they are of the correct thread and torqued to manufacturer's specifications. All locating dowels shall be installed. In instances where holes are open to the crankcase, bolts must 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.
- E. Exhaust system should be checked for flow, leakage and condition.
- F. Engine mountings should be renewed if there are any signs of rubber deterioration, perishing, softening, oil soaking, or if the fastening holes are damaged or elongated.
- G. Correct function of oil pressure gauge and warning light should be verified.
- H. Correct function of water temperature and over-temperature warning light should be verified.

B7 SERVICE

First and subsequent services should be carried out in accordance with the reconditioner's specifications.

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. A typical running-in procedure which would be acceptable in most instances is as follows:

- A. Avoid prolonged idling and engine labouring.
- B. Once oil pressure has built up, warm up engine at a speed of around 1500 r/min.
- C. In the initial driving period accelerate several times from 60-90 km/h in top gear at full throttle. This provides load to build up pressure behind the compression rings to ensure gastight sealing against the cylinder walls.

Avoid prolonged high speeds for the first few hundred kilometres and vary highway cruising speeds.