British Standard BS.AU.257.2002

1 Scope
This British Standard gives recommendations for the techniques to be followed and tasks to be completed in the remanufacture of a spark or compression ignition engine or of a major assembly.

2 Definitions
For the purposes of this British Standard the following definitions apply.

2.1 Remanufactured engine or major assembly Used engine or major assembly that has been returned to a near-new state in accordance with the manufacturer's original specification, with fits and clearances to provide similar performance, reliability and longevity comparable to that of a new engine. NOTE 1 For the purposes of this British Standard, "remanufactured" is synonymous with "reconditioned". NOTE 2 An "exchange", "factory", "rebuilt", "repaired" or "replacement" engine or assembly is unlikely to have been subjected to re-machining, major replacement of parts or restoration of all fits and clearances and is therefore not to be confused with a remanufactured engine.

2.2 Renewed component
New item sourced from the manufacturer or supplier who can demonstrate fitness for purpose.

2.3 Major assemblies

2.3.1 Short engine
Cylinder block consisting of the crankshaft, connecting rods, pistons and oil and water gallery blanking plugs.

2.3.2 Cylinder head
Unit consisting of all inlet and exhaust valves, valve seats, valve springs and retainers.

2.4 Long engine
Unit consisting of a short engine (see 2.3.1), cylinder head assembly (see 2.3.2), camshaft, cam followers and/or lifters and push rods (where fitted), a cam and/or valve gear cover, an oil pump, timing gears, a timing chain, a timing chain tensioner and a cover or timing belt, a belt tensioner and timing wheels. The cylinder block is closed by an engine oil sump with the exception of engines where the transmission case forms the sump.

3 General

3.1 All engines or assemblies should be dismantled, the oil and water gallery, cylinder block and head core plugs removed, and components thoroughly cleaned, degreased and decarbonized.

3.2 All components should be inspected against manufacturers' tolerances and should be machined or renewed as necessary. It is essential that the following components are renewed entirely: pistons; piston rings; gudgeon pins and retainers; wet cylinder liners (unless rebored); main bearings; big end bearings; thrust washers where fitted; small end bushes; gaskets; oil seals; core plugs; filters; timing chains or timing belts. New lock

washers should be fitted; if unavailable, an alternative locking device should be fitted. If damaged, threaded holes should be retapped or fitted with thread inserts, or plugged and redrilled and tapped. Loose dowels should be replaced with oversize dowels. All splines, keys, keyways and fasteners should be examined for damage and renewed as necessary.

4 Cylinder blocks

4.1 The cylinder block should be rebored or resleeved and honed to the piston manufacturer's specification and dimensions, including appropriate surface finish. The recesses of cylinder blocks fitted with removable liners should be examined and trued, and the seal areas should be examined and remachined as necessary. New liner seals should be fitted. All dimensions should be restored to the manufacturer's tolerances as necessary before liners are fitted. It is essential that crack testing and/or pressure testing are conducted.

4.2 The main bearing housings should be examined for size, misalignment and damage, and should be remachined as necessary to ensure correct fit of the new bearings. The locations of thrust bearings should be checked and, if out of tolerance, reclaimed and/or machined as necessary.

4.3 Where the camshaft runs directly in the cylinder block, the camshaft bearings should be measured for ovality, alignment and taper to ensure clearances are to the manufacturer's specification. Suitable new oversize or undersize bearings may be fitted where available. Where cam followers run directly in the cylinder block, the cam follower housing should be examined for damage and measured for wear to ensure clearances are to the manufacturer's specification.

4.4 The top face of the cylinder block top should be measured for flatness and examined for damage and, if required, surface-ground or milled to a surface finish conforming to the engine or gasket manufacturer's specifications. Particular attention should be given to maintaining deck heights within the manufacturer's specifications.

4.5 All oil and water galleries should be thoroughly cleaned prior to assembly.

5 Cylinder heads

5.1 The cylinder block to head face should be cleaned and measured to ensure flatness, and should be machined as necessary to ensure flatness and that corrosion is eliminated from water ports within the gasket sealing area. The cylinder head thickness should be maintained within the manufacturer's or remanufacturer's specification. The surface finish should be as specified by the engine or gasket manufacturer. It is essential that crack testing and/or pressure testing are conducted. The rocker cover/cam housing joint face should be measured for distortion and examined for damage, and should be machined as required.

5.2 Where camshafts run directly in the cylinder head, bearings should be measured for ovality, taper and alignment to ensure clearances are to the manufacturer's specification. Where the cam followers run directly in the cylinder head, the cam follower housing should be examined for damage and measured for wear to ensure clearances are to the manufacturer's specification.

5.3 Valve guides should be measured for wear and, if necessary, resized, resleeved or renewed to conform to the manufacturer's specification.

5.4 Valve springs should be measured against the manufacturer's tolerances for squareness, free length and compressed load length and should be renewed as necessary.

5.5 Valve collets should be examined for wear and damage and should be renewed as necessary.

5.6 Valves should be examined for damage, measured for straightness, head thickness and stem wear, and refaced or renewed as necessary.

5.7 Valve seats should be remachined and inserts renewed as necessary. The valve seat height should conform to the manufacturer's specification.

5.8 All valve operating assemblies should be completely dismantled, cleaned and examined for wear and other defects. Components should be machined or renewed as necessary. Push rods should be examined for straightness, damage and wear, and should be renewed as necessary. It is essential that the valve train geometry is maintained on the component assembly.

5.9 All oil and water galleries should be thoroughly cleaned prior to assembly.

6 Crankshafts

6.1 The oil gallery plugs should be removed as necessary and the crankshaft should be examined for damage. Diesel engine crankshafts should be crack tested after any machining process and prior to assembly.

6.2 Sealing diameters and nose ends should be measured and, if necessary, reclaimed. Journal wear, blended radii, thrust wear and alignment should be measured. Certain crankshafts may be straightened, depending upon the material, but it is essential that this operation is followed by further crack detection.

6.3 Crankshafts should be reground or polished to conform to the bearing manufacturer's dimensional, surface finish and hardness specification. One or more crankshaft journals and seal areas may be reclaimed by recognized welding or metal spraying techniques and then reground to maintain parity with the other journals. It is essential that crankshaft hardness is maintained to the manufacturer's specification.

6.4 After grinding, all crankshafts should be polished to conform to the bearing manufacturer's specification for surface finish.

6.5 All oil holes should be deburred and oil galleries thoroughly cleaned prior to assembly.

7 Camshafts

7.1 Camshafts should be examined for damage and measured for straightness and wear on journals, lobes and skew gear. If necessary the cam lobes should be reprofiled or the camshaft renewed.

7.2 Cam followers should be refaced or renewed as necessary. All hydraulic valve operating components should be renewed if unserviceable after a full strip and inspection.

8 Connencting rods

8.1 Big end bearing housings should be measured for size and ovality and should be resized as necessary. Side faces should be examined, and bearing keeps and oilways deburred and thoroughly cleaned prior to assembly.

8.2 Connecting rods should be measured for alignment and straightened as necessary.

8.3 Small end bushes should be renewed and remachined to give the gudgeon pin to bush clearance specified by the manufacturer, after ensuring that the housing is within dimensional limits. The interference fit of press-fit gudgeon pins to small end bores should be maintained to the manufacturer's specification.

8.4 Big end studs and bolts should be examined and any showing signs of stretch or damage should be renewed.

8.5 Connecting rods should be matched as a weighted set.

9 Oil pumps
Oil pumps should be examined for internal scoring and damage and measured for rotor to body clearance as defined by the manufacturer. The pressure relief valve assembly should be dismantled and cleaned. All non-conforming parts should be renewed.

10 Water pumps
If fitted by the re-manufacturer, water pumps should be remanufactured to the original equipment specification or renewed.

11 Ancillary equipment

11.1 All tooth belts and timing chains should be renewed. Chain wheels and gears should be examined for wear or damage and renewed as necessary.

11.2 Worn timing chain guides and chain tensioners should be renewed.

11.3 Toothed belt sprockets should be examined for wear or damage and renewed as required.

11.4 Where fitted, crankshaft torsional vibration dampers and/or crankshaft pulleys should be examined for wear or damage and renewed as required.

11.5 Any other components, the condition of which may influence engine performance or durability, should be stripped, examined and remanufactured or renewed as necessary.

11.6 All fasteners and threads should be examined and renewed as necessary.

12 Assembly

12.1 All components should be thoroughly cleaned before assembly. Engine reassembly should be carried out strictly in accordance with the manufacturer's guidelines, with particular attention being paid to bolt tightening sequences and torque procedures.

12.2 It is essential that measurements include piston heights, valve-pocket depths, piston-skirt clearance, valve timing, tappet clearances, and crankshaft end float and bearing clearances. It is essential that tests are carried out during assembly to ensure that each valve and its seat forms an efficient seal. It is essential that breathing components forming part of the engine are neither contaminated nor damaged.

12.3 The remanufactured engine or major assembly should be permanently identified by a unique serial number. This serial number should be reproduced on the warranty document.

13 Testing procedures
A minimum test for a long engine should be capable of indicating or detecting the following:

a) oil pressure; b) compression; c) oil leaks.

Items a) and b) should be recorded.

14 Documentation

14.1 Each remanufactured engine or major assembly should have its own build document containing records of:

a) components renewed; b) serial number; c) completion date; d) test records.

This document should be retained by the remanufacturer and made available to the customer in the event of a dispute.

14.2 An information pack detailing the following should be attached to the remanufactured engine or major assembly:

a) serial numbers; b) fitting instructions; c) running-in procedures; d) written warranty.

15 Presentation and protection
The completed remanufactured engine or major assembly should be painted and suitably protected against ingress of dirt, corrosion and physical damage.