

General description

The cylinder block is made of cast iron and provides a full length support for the dry liners which are also made of cast iron. Production liners are a press fit in the block and service liners are a transition fit. Both types of liners are honed with silicon carbide tools to a specially controlled finish to ensure long life and low oil consumption. A bush is fitted in the cylinder block for the front camshaft journal and the other camshaft journals run directly in the block.

Cylinder block

To dismantle and to assemble

16A-01

To dismantle

- 1 Drain the cooling system and the lubricating oil.
- 2 Remove the engine from the vehicle or machine.
- 3 Remove the alternator drive belts and the alternator and its mounting brackets, see section 23.
- 4 Remove the fan, the fan drive and the water pump, see section 21.
- 5 Remove the compressor or the exhauster, where fitted, see section 24.
- 6 Remove the fuel filter, the atomisers and the fuel injection pump, see section 20.
- 7 Remove the lubricating oil cooler, where fitted, operation 21A-07.
- 8 Remove the lubricating oil filter assembly and the lubricating oil sump, see section 19.
- 9 If necessary, remove the turbocharger, operation 18A-01.
- 10 Remove the fuel lift pump, operation 20A-03.
- 11 Remove the starter motor, operation 23B-01.
- 12 Remove the cylinder head assembly, operation 12A-07.
- 13 Remove the timing case and the timing gears, see section 15.
- 14 Remove the lubricating oil pump and the pressure relief valve, see section 19, or remove the balancer unit, operation 14A-10.
- 15 Remove the piston and connecting rod assemblies, operation 13A-04.
- 16 Remove the camshaft and the tappets, operation 15A-09.
- 17 Remove the flywheel and the flywheel housing, see section 22.
- 18 Remove the rear oil seal assembly and the crankshaft, see section 14.
- 19 Remove the piston cooling jets, operation 13A-09, or remove the plugs if jets are not fitted.

To assemble

- 1 Clean thoroughly the new cylinder block. Ensure that all the oil passages are clean and free from debris.
- 2 Remove the screw plugs from the old cylinder block and clean the threads. Seal the threads with POWERPART Threadseal, or a similar sealant, and fit the screw plugs into the new cylinder block.
- 3 Fit the piston cooling jets, or the plugs where jets are not fitted, operation 13A-09.
- 4 Fit the crankshaft and the rear oil seal assembly, see section 14.
- 5 Fit the flywheel housing and the flywheel, see section 22.
- 6 Fit the tappets and the camshaft, operation 15A-08.
- 7 Fit the lubricating oil pump and the pressure relief valve, see section 19, or fit the balancer unit, operation 14A-10.
- 8 Fit the timing case and the timing gears, see section 15.
- 9 Fit the cylinder head assembly, operation 12A-07.
- 10 Fit the starter motor, operation 23B-01.
- 11 Fit the fuel lift pump, operation 20A-03.
- 12 If necessary, fit the turbocharger, operation 18A-01.
- 13 Fit the lubricating oil filter assembly and the lubricating oil sump, see section 19.
- 14 If necessary, fit the lubricating oil cooler, operation 21A-07.
- 15 Fit the fuel filter, the atomisers and the fuel injection pump, section 20.
- 16 If necessary, fit the compressor or the exhauster, see section 24.

- 17 Fit the fan, the fan drive and the water pump, see section 21.
- 18 Fit the alternator and its mounting brackets and the alternator drive belts, see section 23.
- 19 Install the engine into the vehicle or machine.
- 20 Fill the cooling system.
- 21 Fill the lubricating oil sump to the correct level with an approved lubricating oil.
- 22 Eliminate air from the fuel system, operation 20A-08.

To inspect

16A-02

- 1 Clean the passages for the coolant and for the oil.
- 2 Check the cylinder block for cracks and for other damage.
- 3 The top face of the cylinder block must not be machined as this will affect the liner flange depth and the piston height above the top face of the cylinder block.
- 4 Check the camshaft bush for wear. If the bush is to be renewed, use a suitable adaptor to press it out of the bore. Ensure that the lubricating oil hole in the new bush will be towards the front of the engine, when fitted. Press in the bush with the oil hole on the same side and aligned with the oil hole in the block until the front end of the bush is aligned with the face of the recess.

Cylinder liner

To inspect

16A-03

Check the liners for damage and wear. To check the wear of the liner bore see A and B. The maximum permissible wear is 0,25 mm (0.010 in).

An engine can have high oil consumption with very little wear of the liner bores, if the surfaces of the liners are glazed.

To remove glaze from the bore

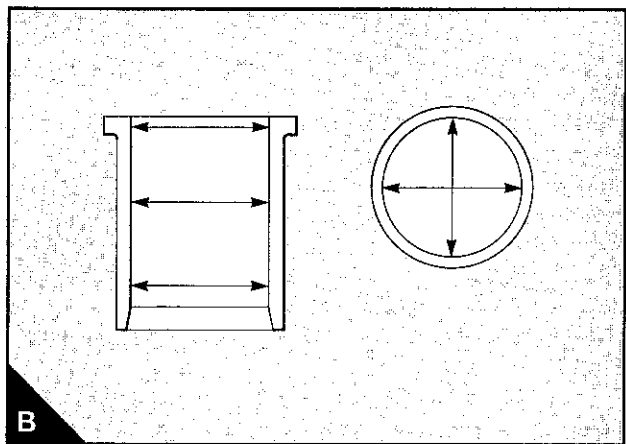
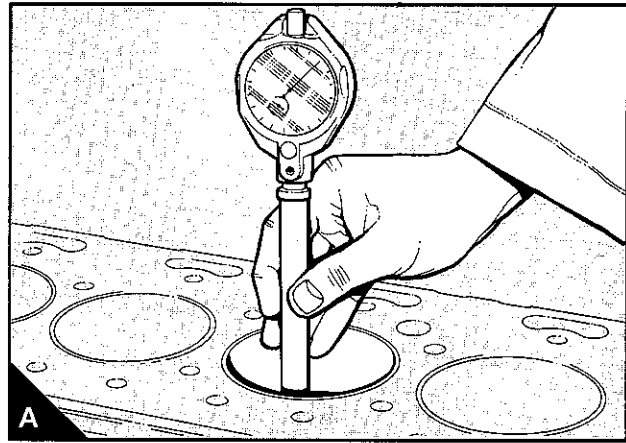
16A-04

A tool, known as a 'Flex-Hone', is available to correct the liner surface. This tool can be used with an electric hand drill at low speed. The pistons and connecting rods must be removed and the piston cooling jets, where fitted, must also be removed. Use covers to protect all engine components from the debris which is caused during the process.

- 1 Grade 80SC 'Flex-Hone' is to be used. A 4 in or 4 1/8 in size 'Flex-Hone' can be used according to how badly the bore is glazed.
- 2 New 'Flex-Hones' must be operated in an old liner before use on an engine to remove all loose material and sharp edges.
- 3 Lubricate lightly the liner and the 'Flex-Hone' with clean engine lubricating oil.
- 4 Put the tool in position on top of the liner, but do not press the tool into the liner until the tool is operated.
- 5 Operate the tool and move it up and down the liner bore once a second for 30-50 seconds. Remove the tool while it rotates.
- 6 Clean thoroughly the liner bore to remove all dirt from the operation, use a hard brush and kerosene.
- 7 Dry the liners and remove carefully all the covers used to protect the components. Clean thoroughly all the engine components which have been affected by debris.
- 8 Fit the piston cooling jets or the plugs. Ensure that new piston rings are fitted when the engine is assembled in accordance with the relevant sections of this workshop manual.

Attention: After a glazed bore has been corrected, these recommendations are advised for the first 240 km (150 miles) or 5 hours of operation:

- Do not operate the engine at full load.
- Do not operate the engine at high speed.
- Do not allow the engine to run at low idle speed for extended periods.



To remove and to fit

16A-05

Special tools:

Remover/replacer for cylinder liner (main tool), PD.150B

Adaptors for use with PD.150B, PD.150B-17

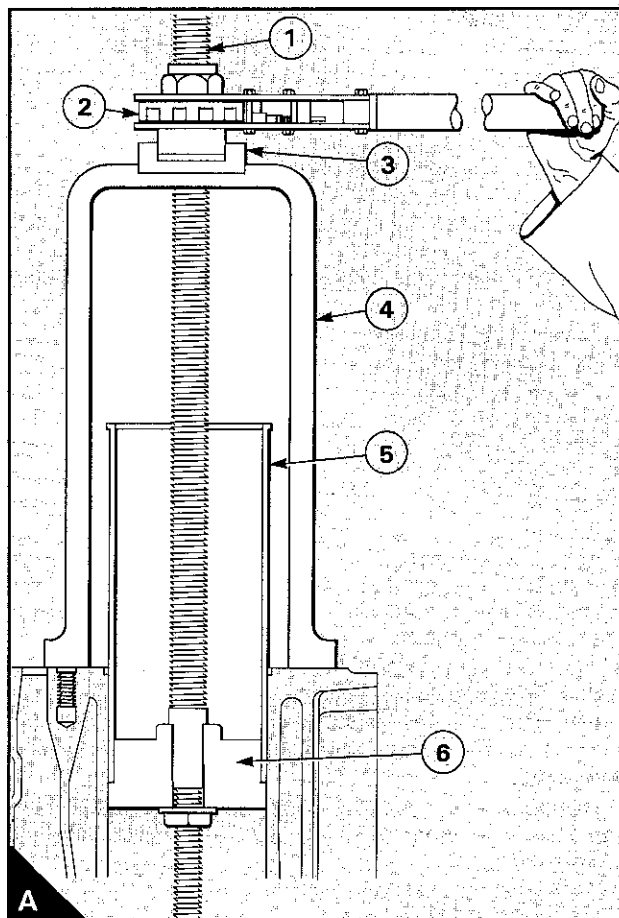
Depth gauge liner flange, PD.41D

Dial gauge for use with PD.41D, PD.208

Where several liners are to be removed or a very tight production liner is fitted, a press should be used. Where a single liner is to be removed or the crankshaft is to remain in position, a tool for hand operation is available.

To remove

- 1 Drain the lubricating oil and remove the lubricating oil sump, operation 19A-03.
- 2 Remove the cylinder head assembly, operation 12A-07.
- 3 Remove the piston and connecting rod assembly, see operation 13A-03.
- 4 Carefully remove the piston cooling jet, where fitted, operation 13A-09.
- 5 Turn the crankshaft to give access to the cylinder liner and protect the crank pin.
- 6 Put the tool (A4) on the top face of the cylinder block and over the centre of the liner. Ensure that the base of the tool is not on top of the liner flange of the next cylinder.
- 7 Put the bearing (A3) in the recess in the top of the tool with the flat face of the bearing to the bottom of the recess.
- 8 Fit the threaded rod (A1) through the bearing and the top of the tool until the handle (A2) is in the recess in the top of the bearing. In this position adjust the threaded rod until the end is below the bottom of the cylinder liner. Fit the adaptor PD.150B-17/1 (A6) onto the threaded rod and against the bottom of the cylinder liner. Ensure that the two lugs on the top of the adaptor engage with the flats on the threaded rod. Fit the washer and nut and tighten the nut onto the adaptor.
- 9 Lubricate the ratchet of the handle and the threaded rod with Shell Spirax oil or an equivalent oil. Operate the handle and pull the cylinder liner out of the top of the cylinder block.



To fit a service liner

A service liner is a transition fit of $\pm 0,03$ mm (± 0.001 in) in the parent bore. A special tool will not be necessary to fit some liners, but where a liner is a tight fit, tool PD150B can be used. Do not hit a liner with a hammer.

1 Clean thoroughly the parent bore. Clean the top 50 mm (2.0 in) and the recess for the liner flange with Loctite Safety Solvent or a similar product; use it in accordance with the manufacturer's instructions.

2 Clean thoroughly the outer surface of the liner with Loctite Safety Solvent.

3 Lubricate lightly the parent bore with clean engine lubricating oil, except for the top 50 mm (2.0 in).

4 Engage the cylinder liner (A5) into the parent bore; ensure that the liner is vertical. Put the adaptor PD.150B-17/2 (A4) onto the top of the liner with the shoulder of the adaptor on the liner flange. Put the bearing (A3) into position in the recess in the top of the adaptor with the flat face of the bearing to the bottom of the recess.

5 Fit the threaded rod (A1) through the bearing, the adaptor and the liner until the handle is against the recess in the bearing. In this position adjust the threaded rod until the end is below the bottom face of the cylinder block.

6 Fit the adaptor PD150B/6 (A6) onto the threaded rod; ensure that the flat face of the adaptor is against the bottom face of the cylinder block. Fit the washer and the nut; ensure that the threaded rod is in the centre of the liner and tighten the nut onto the adaptor.

7 Lubricate the ratchet of the handle and the threaded rod with Shell Spirax oil or an equivalent oil. Operate the handle and press the liner into the parent bore to within 50 mm (2.0 in) of the fitted position. Clean the area below the flange of the liner with Loctite Safety Solvent. Apply Loctite 602 to the top 25 mm (1.0 in) of the outer surface of the liner and under the flange; also apply Loctite 602 to the bottom of the flange recess in the parent bore.

8 Press the liner in to the fully fitted position. Remove the tool and clean the Loctite from the top of the cylinder block.

9 Allow 15 minutes to elapse before the liner bore dimension is checked. The Loctite will reach full strength after 3 hours.

10 With tool PD41D, check that the liner flange is between 0,10 mm (0.004 in) above to 0,10 mm (0.004 in) below the top face of the cylinder block (B).

11 Fit new piston rings, operation 13A-04.

12 Fit the piston and connecting rod assembly, operation 13A-03.

13 If necessary, fit the piston cooling jet, operation 13A-09.

14 Fit the cylinder head assembly, operation 12A-07.

15 Fit the lubricating oil sump, operation 19A-03, and fill it to the correct level with an approved lubricating oil.

Attention: After a new service liner has been fitted, these recommendations are advised for the first 240 km (150 miles) or 5 hours of operation:

- Do not operate the engine at full load.
- Do not operate the engine at high speed.
- Do not allow the engine to run at low idle speed for extended periods.

