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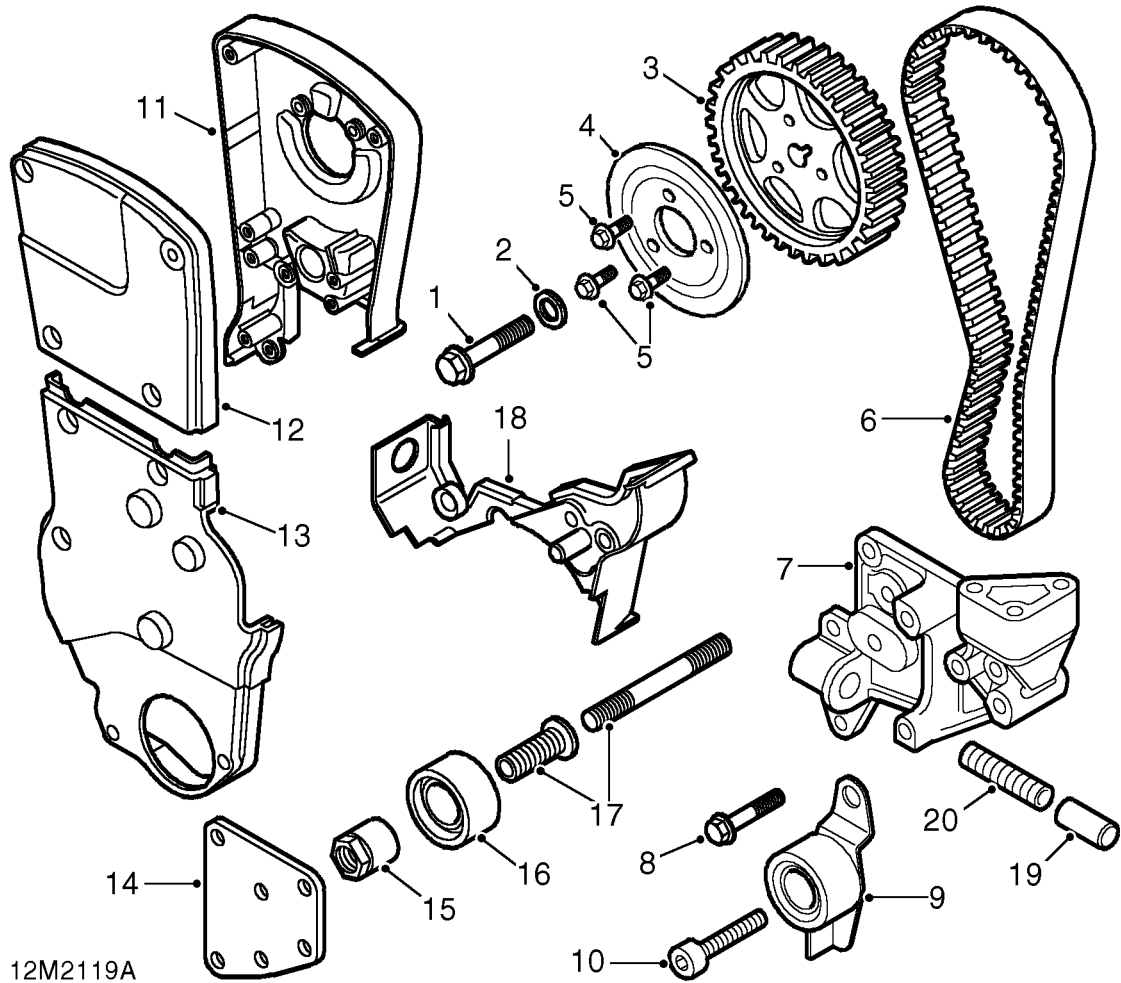
ENGINE

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12M2119A

CAMSHAFT TIMING BELT COMPONENTS

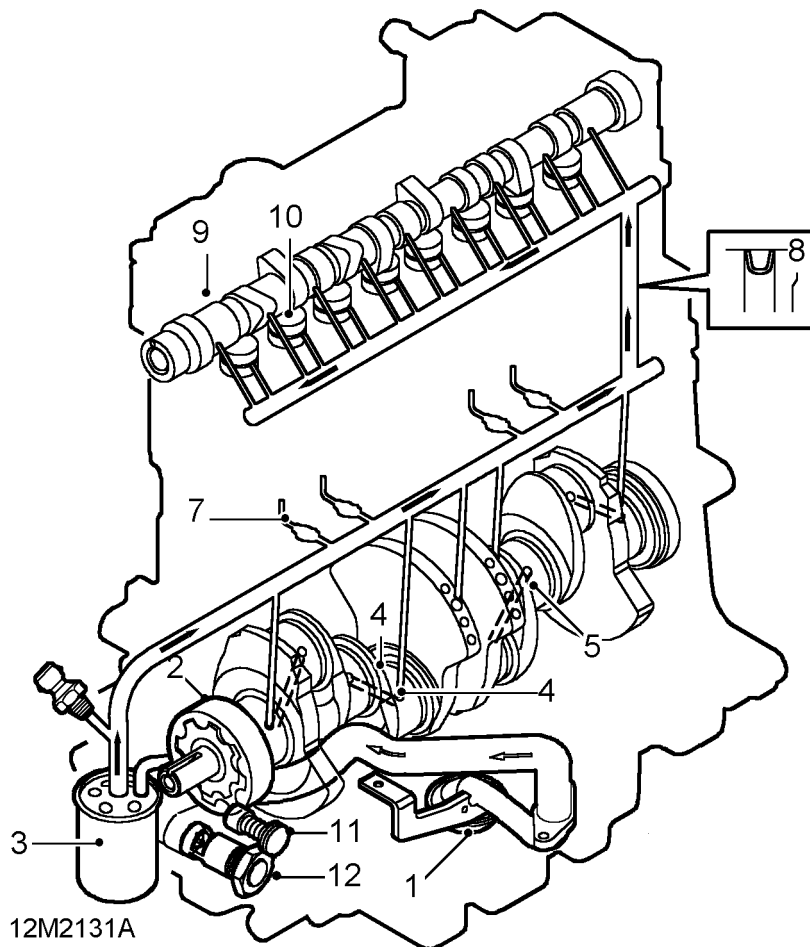
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|----------------------------------------|---------------------------------------|
| 1. Bolt - timing belt gear | 11. Timing belt upper rear cover |
| 2. Washer | 12. Timing belt upper front cover |
| 3. Timing belt gear | 13. Timing belt lower front cover |
| 4. Timing belt gear damper | 14. Engine front mounting cover plate |
| 5. Torx screws - damper to timing gear | 15. Nut - idler pulley |
| 6. Camshaft timing belt | 16. Idler pulley |
| 7. Tensioner housing | 17. Stud and adaptor - idler pulley |
| 8. Bolt - tensioner pulley | 18. Timing belt lower rear cover |
| 9. Tensioner pulley | 19. Tensioner plunger |
| 10. Allen screw - tensioner pulley* | 20. Tensioner spring |

* Later engines - Allen screw is replaced by a bolt.



CYLINDER BLOCK COMPONENTS

1. Cylinder block
2. Foam pad
3. Gearbox adaptor plate
4. Circlip - gudgeon pin
5. Gudgeon pin
6. Piston
7. Connecting rod
8. Bolt - connecting rod
9. Big-end bearing shells
10. Big-end bearing cap
11. Crankshaft rear oil seal and housing
12. Top compression ring
13. 2nd compression ring
14. Oil control ring
15. Crankshaft
16. Woodruff key
17. Dipstick
18. Dipstick tube
19. Main bearing cap
20. Thrust washer
21. Upper main bearing shell - grooved
22. Lower main bearing shell - plain
23. Bolt - main bearing cap
24. Gasket - sump
25. Sump
26. 'O' ring
27. Oil strainer and pick-up pipe
28. Bolt - sump
29. Drain plug
30. Sealing washer
31. Oil squirt jet
32. Banjo bolt
33. Gasket - oil pump
34. Oil pump
35. Bolt - M6
36. Bolt - M10
37. Crankshaft front oil seal
38. Sealing ring
39. Oil filter element
40. Timing gear
41. Crankshaft pulley
42. Bolt - crankshaft pulley



Lubrication

Oil is drawn through a gauze strainer (1) and through a passage in the cylinder block to the oil pump (2). Pressurised oil flows via the full flow filter (3) to the main oil gallery in the cylinder block. Drillings from the main oil gallery direct oil to the crankshaft main bearings (4) and cross drillings in the crankshaft direct oil to the big-end bearings (5). Additional drillings in the cylinder block supply oil at reduced pressure to the oil squirt jets (7) for piston cooling and gudgeon pin lubrication and via a restrictor (8) in the top of the cylinder block to the rear of the cylinder head. A full length drilling in the cylinder head directs oil to the camshaft journals (9) and tappets (10).

An oil pressure relief valve (11) is located in the oil pump body which also carries the oil filter adapter and the return union for the externally mounted oil cooler.

A thermostatic valve (12), comprising a valve, spring and diverter plug is located in the oil pump body. The oil flow union to the oil cooler is screwed into the end of the diverter plug. The valve is closed during engine warm-up thereby preventing oil flow to the oil cooler. As the oil reaches a pre-determined temperature, the valve opens and allows oil to flow to the cooler.

Crankcase ventilation

A positive crankcase ventilation system is used to vent crankcase gases to the air induction system.

The gases are drawn from the camshaft cover, through a depression limiting valve and into the turbocharger intake.

As engine speed increases, the depression limiting valve progressively closes thereby limiting the depression in the crankcase.



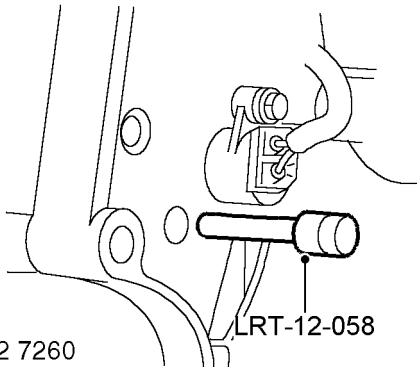
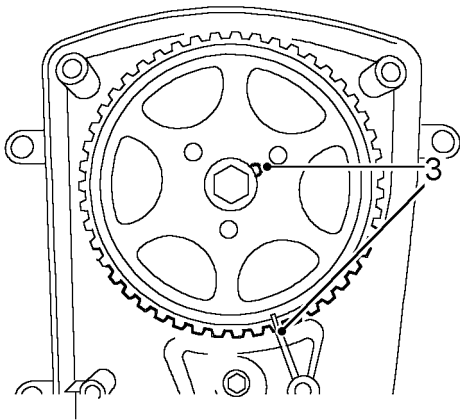
Camshaft timing belt - refit and adjust

1. Clean tensioner and idler pulleys and timing belt gears.



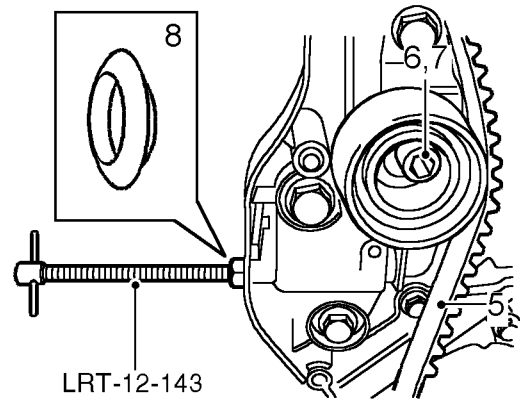
CAUTION: If the sintered gears have been subjected to prolonged oil contamination, they must be soaked in a solvent bath and then thoroughly washed in clean solvent before refitting.

2. Check that camshaft timing belt upper and lower cover sealing strips are correctly located in covers.



M12 7260

3. Ensure that timing pin **LRT-12-058** is inserted in flywheel, and camshaft gear timing mark is aligned exactly with pointer on timing belt upper rear cover.



M12 7261

4. Screw timing belt tensioner retractor tool **LRT-12-143** into tensioner plunger. Tighten nut on tool to fully retract tensioner.
5. Using the fingers only, ease a new timing belt over crankshaft and camshaft gears keeping it as taut as possible on the idler pulley side.
6. Loosen Allen screw until tensioner pulley moves easily without tipping.



NOTE: Later engines - Allen screw is replaced by a bolt.

7. Loosen nut on tool **LRT-12-143** until tensioner is released; tighten Allen screw or bolt to 55 Nm and remove tool.



CAUTION: Do not exceed specified torque figure.

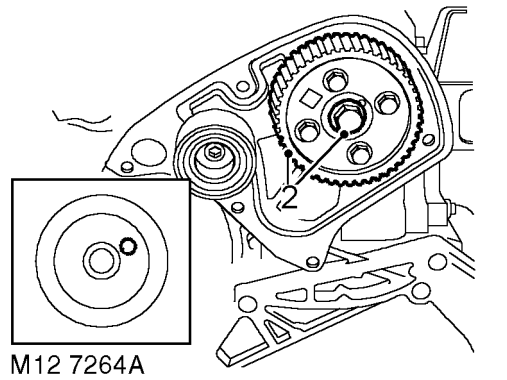
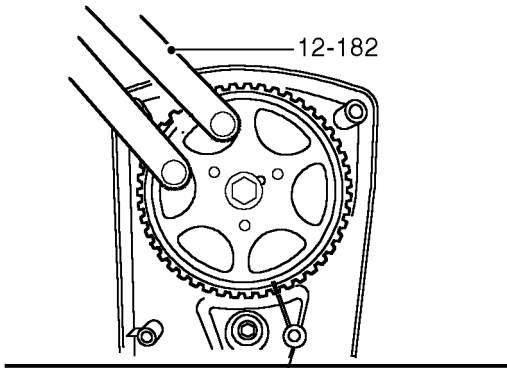
8. Insert timing belt tensioner access plug into lower rear cover.

ENGINE


CYLINDER HEAD ASSEMBLY

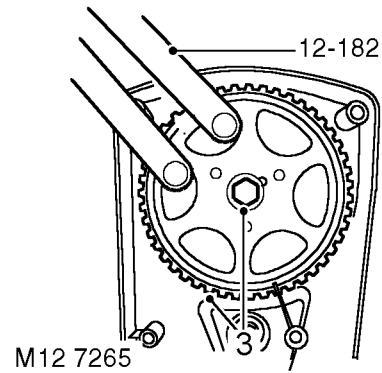
Remove

1. Remove and discard camshaft timing belt.




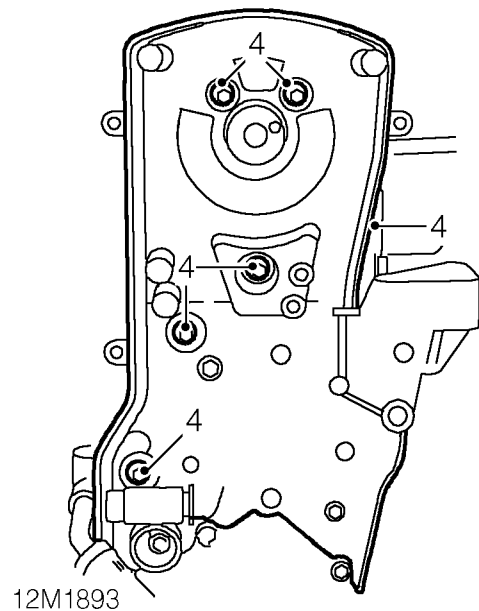
2. Restrain camshaft timing belt gear using tool **12-182** and remove bolt securing fuel injection pump drive belt gear to camshaft, remove gear, discard bolt.

 **CAUTION: Ensure camshaft does not rotate when removing bolt and do not rotate crankshaft or camshaft with timing belt removed and cylinder head fitted.**



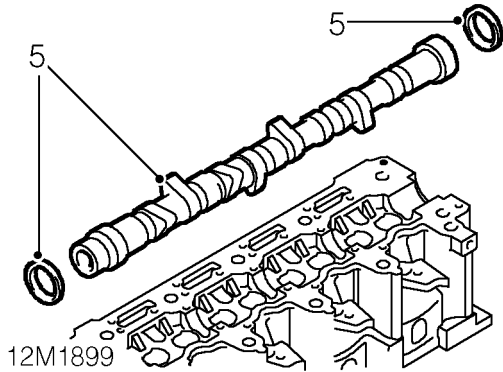
3. Restrain camshaft timing belt gear using tool **12-182** and remove bolt securing camshaft timing belt gear. Remove gear and discard bolt.

 **CAUTION: Ensure camshaft does not rotate when removing bolt and do not rotate crankshaft or camshaft with timing belt removed and cylinder head fitted.**

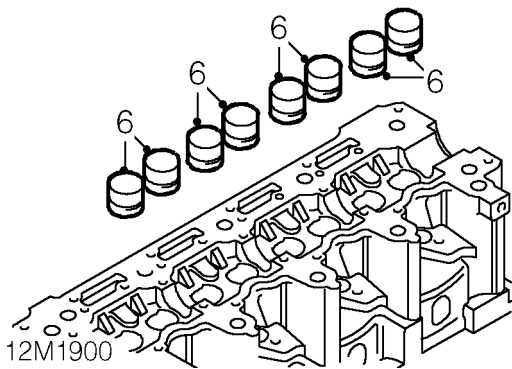


4. Remove 5 screws securing camshaft timing belt upper rear cover, remove cover, recover sealing strip.

 **NOTE: Shortest screws are fitted in camshaft carrier.**



5. Remove camshaft, remove and discard front and rear oil seals.



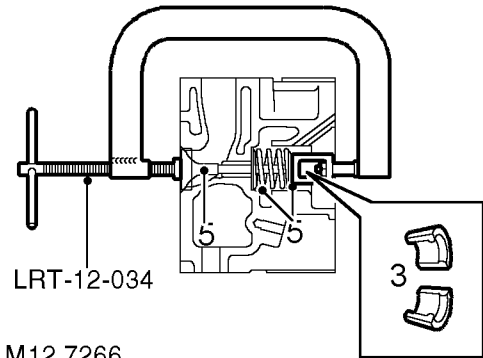
6. Using a stick magnet, remove 8 tappets from the cylinder head.



CAUTION: Keep tappets in their fitted order and store inverted to prevent oil loss. Do not squeeze tappet chambers together.

Valves and springs - remove

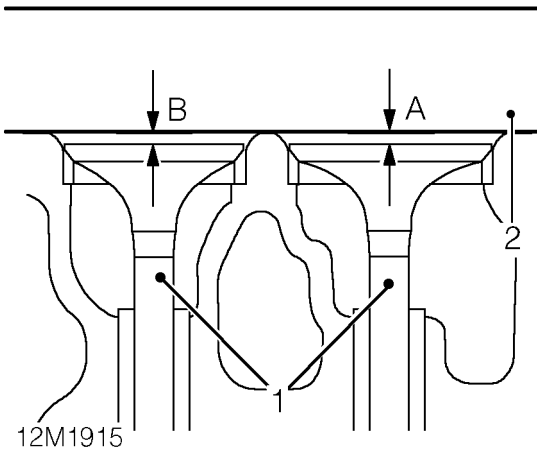
1. Support cylinder head clear of valves, use a hollow drift and tap each spring cap to free collets.



2. Using tool **LRT-12-034**, compress valve spring.
 3. Remove 2 collets from valve stem using a stick magnet.
 4. Remove tool **LRT-12-034**.
 5. Remove spring cap and valve spring, remove valve.



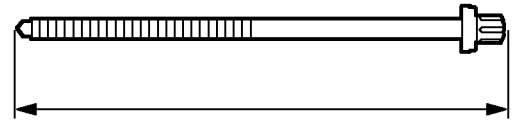
Valve head stand down



1. Insert each valve into its respective guide.
2. Using a straight-edge and feeler gauges, check and record stand down of each valve head.
3. Compare figures obtained with figures given below. If any valve has a stand down greater than specified, valve seat insert and valve must be replaced:
 Valve head stand down:
 Inlet valve **A**= 1.45 mm.
 Exhaust valve **B**= 1.35 mm.

Cylinder head bolts - inspection

1. Keeping bolts in their fitted order, clean bolts and washers, lightly oil threads.

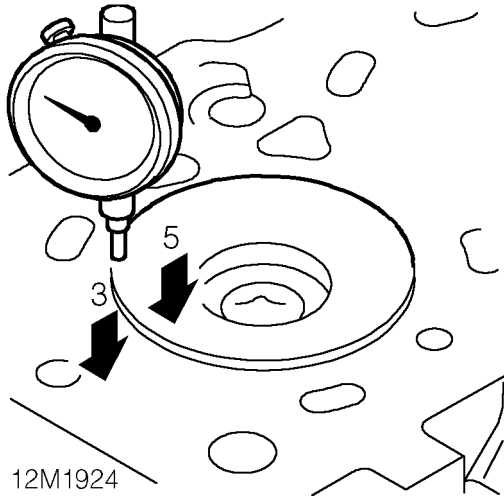


12M1916

2. Check bolt heads and threads for damage, replace individual bolts as necessary.
3. Check length of bolt from top of bolt head to end of bolt. If any bolt exceeds 243.41 mm in length, all 10 bolts and washers must be replaced.



CAUTION: Do not attempt to remove washers from bolts. Keep bolts in their original fitted order.



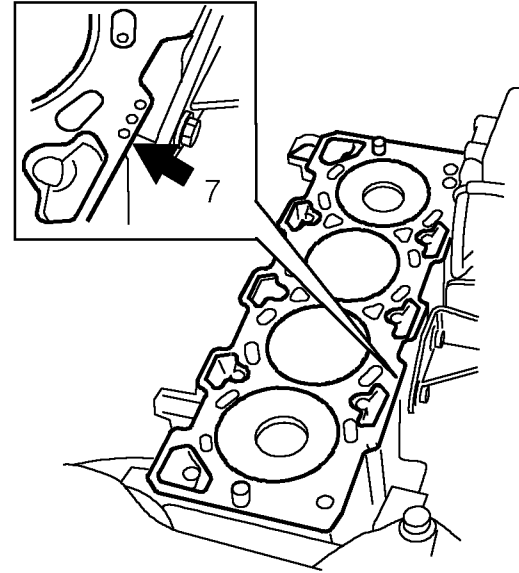
12M1924

3. Assemble a magnetic base DTI to cylinder block top face, zero DTI with stylus touching block top face.
4. Rotate crankshaft in a clockwise direction until Number 1 piston is at TDC.
5. Position stylus near edge of piston crown, measure and record Number 1 piston protrusion.



NOTE: Measurement must be taken at front and rear of piston.

6. Repeat above procedure for remaining pistons.



12M1923

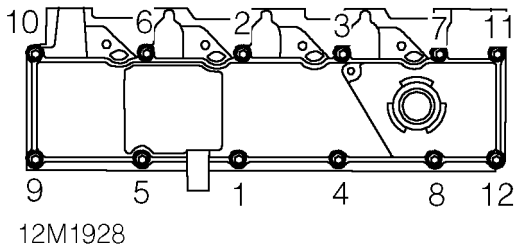
7. From readings obtained, determine highest piston protrusion figure and select the appropriate cylinder head gasket:
 - Protrusion 0.10 to 0.25 mm - Select gasket with one identification hole.
 - Protrusion 0.25 to 0.40 mm - Select gasket with two identification holes.
 - Protrusion 0.40 to 0.55 mm - Select gasket with three identification holes.

ENGINE

29. Fit a new gasket to camshaft cover ensuring that raised holes in gasket are towards the cover and are located on the two spigots.



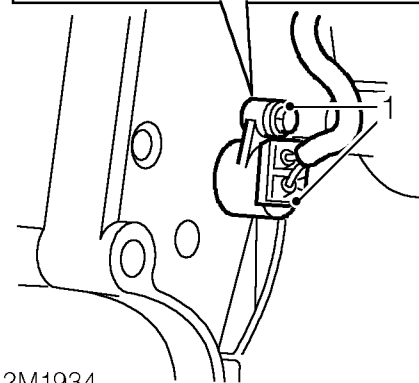
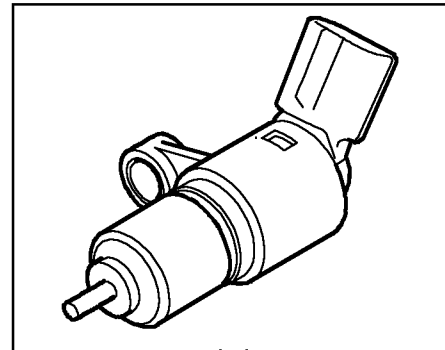
CAUTION: Gasket must be fitted dry.



30. Fit camshaft cover bolts and tighten in sequence shown to 12 Nm.

FLYWHEEL AND STARTER RING GEAR

Flywheel - remove



12M1934

1. Remove bolt securing crankshaft sensor to gearbox adaptor plate. Remove sensor.

ENGINE

Starter ring gear - refit

1. Heat ring gear evenly to 350°C indicated by light blue colour. Locate ring gear on flywheel and press on to flange.



WARNING: Handle hot ring gear with care.

2. Allow ring gear to air cool.
3. Fit flywheel.

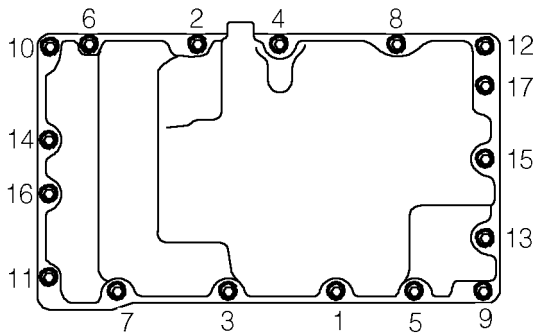
Flywheel - refit

1. Clean threads in crankshaft using an old flywheel bolt having 2 saw cuts at 45° along thread of bolt.



CAUTION: Do not use a tap to clean threads.

2. Clean flywheel faces.
3. Using assistance, position flywheel on crankshaft, fit and lightly tighten new Patchlok bolts.
4. Insert timing pin **LRT-12-058** into flywheel.
5. Tighten bolts to 15 Nm then a further 90°.
6. Position crankshaft sensor to gearbox adaptor plate, fit and tighten bolt to 8 Nm.

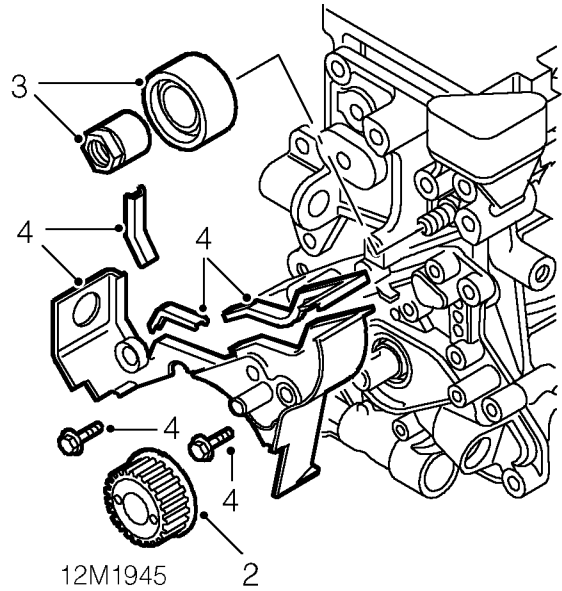


7. Fit and lightly tighten 17 bolts.
8. Using sequence shown, tighten bolts to 25 Nm.
9. Using the same sequence, re-check that all bolts are torqued to 25 Nm.
10. Fit dipstick.
11. Fit oil pump.

OIL PUMP

Remove

1. Remove camshaft timing belt.



2. Slide timing gear off crankshaft.

NOTE: The key is an integral part of the gear.

3. Remove nut securing camshaft timing belt idler pulley, remove pulley.

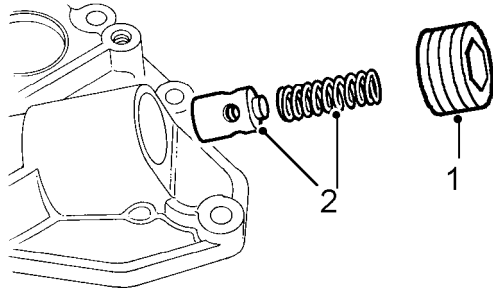
NOTE: Idler pulley mounting stud may be unscrewed as nut is removed.

4. Remove 2 bolts securing camshaft timing belt lower rear cover, remove cover and sealing strips.



Oil pressure relief valve - remove

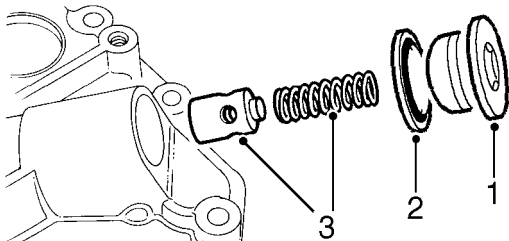
Early engines



12M1955A

1. Remove and discard plug.
2. Remove spring and relief valve plunger.

Later engines



M12 6510

1. Remove and discard plug.
2. Remove and discard Dowty washer.
3. Remove spring and relief valve plunger.

All engines

4. Check plunger and bore for wear, corrosion and scoring.



NOTE: Light scoring may be removed using grade 600 emery cloth soaked in oil.

5. Check spring free length.
Free length = 38.9 mm.
6. Renew relief valve as an assembly.

Oil pressure relief valve - refit

1. Remove all traces of sealant from plug threads in oil pump body.
2. Lubricate spring, relief valve plunger and bore with engine oil.
3. Fit plunger and spring.

Early engines

1. Apply Loctite 577 to threads of replacement plug.
2. Fit plug and tighten to 25 Nm.



CAUTION: Do not attempt to re-seal and fit the original plug.

Later engines

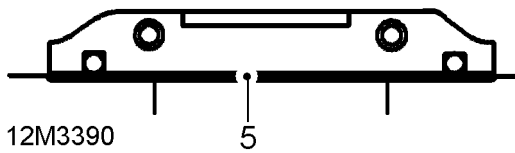
1. Fit a new Dowty washer to replacement plug.
2. Apply Loctite 577 to threads of plug.
3. Fit plug and tighten to 25 Nm.



CAUTION: Do not attempt to re-seal and fit the original plug.

All engines

4. Check oil pressure switch - if fitted for damage, replace as necessary. Apply Loctite 577 to threads of replacement switch; fit switch and tighten to 16 Nm.



5. Apply a 1 mm thick bead of sealant, Part Number GUG 705963GM along joint line of seal housing, rear main bearing cap and cylinder block and around sump bolt holes in rear main bearing cap.



CAUTION: Do not apply sealant until immediately prior to fitting sump, do not spread sealant bead.

Big-end bearings - refit

1. Rotate crankshaft until big-end bearing journals are correctly positioned.
2. Lubricate crankshaft big-end journals with engine oil.
3. Fit new big-end bearing shells to connecting rods, lubricate shells with engine oil.
4. Taking care not to damage oil squirt jets or to displace bearing shells, pull connecting rods on to crankshaft journals.
5. Check that new big-end bearing shells are correctly located on big-end bearing caps, lubricate shells with engine oil.
6. Fit big-end bearing caps ensuring that they are in their correct fitted order.
7. Lubricate threads of connecting rod bolts with engine oil. Fit bolts to their respective connecting rods and tighten to 20 Nm then a further 90°.