

# 8

## Engine timing

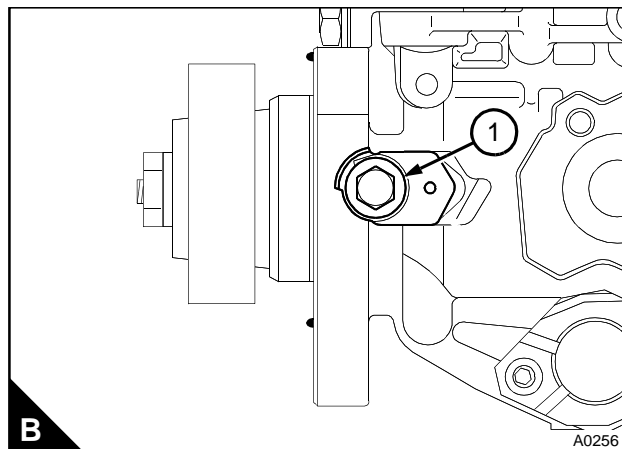
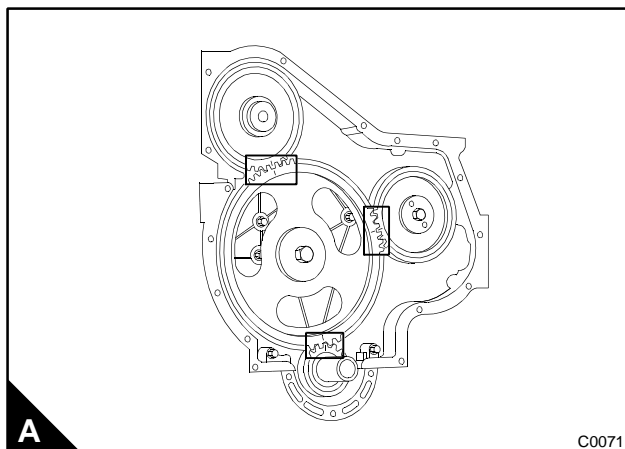
### General description

The timing gears are stamped with timing marks (A) to ensure that they are assembled correctly. The stamped teeth of the crankshaft, camshaft and fuel pump gears will be aligned with the idler gear when number 1 piston is at top dead centre (TDC) on the compression stroke. The marked teeth of the idler gear may not necessarily be aligned in this position, because of to the different speeds at which the gears rotate.

TDC on number 1 cylinder can be found by the alignment of holes in the backplate and the flywheel.

The two types of fuel injection pump available are both timed at TDC on the compression stroke of number 1 cylinder. There is no timing mark on the rear face of the timing case, but there is a mark on the flange of the fuel injection pump.

Both fuel injection pumps have a lock screw (B1) that locks the shaft. When the lock is applied before the pump is removed, it is not necessary to time the pump to the engine if the crankshaft has not been rotated.



## Engine timing

To set the engine to top dead centre (TDC)

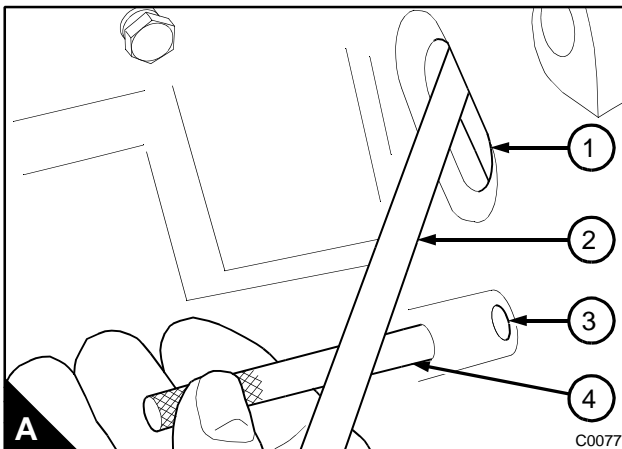
### Operation 8-1

#### Special requirements

Special tools	
Description	Part number
Locking pin for the crankshaft	21836001

TDC on number 1 cylinder on the compression stroke can be found by the alignment of a hole in the flywheel with a hole in the backplate.

- 1 Remove the rocker cover, see Operation 3-1.
- 2 Loosen by two or three turns the setscrews that retain the atomiser clamps or release the gland nuts if threaded atomisers are fitted.
- 3 Rotate the crankshaft clockwise, when seen from the front, until the inlet valve, the first valve, has just closed. There is a slot (A1) in the left side of the backplate, seen from the rear, to give access to the starter ring. A suitable lever (A2) can be used through the slot to rotate the flywheel.
- 4 Insert the locking pin (A4) into the hole (A3) below the slot in the backplate. Continue to rotate the crankshaft clockwise slowly until the pin enters a hole in the flywheel. The engine is now set at TDC number 1 cylinder, compression stroke.
- 5 Remove the pin from the flywheel and the backplate.
- 6 Fit the rocker cover, see Operation 3-1.



---

**To check the valve timing**

---

**Operation 8-2**

---

- 1** Check and, if necessary, adjust the valve tip clearances, see Operation 3-6.
- 2** Set number 1 cylinder to TDC on the compression stroke.
- 3** Make a mark on the crankshaft pulley. Fit a suitable pointer to the timing case cover to align with the mark on the pulley.
- 4** Turn the crankshaft, clockwise from the front, until the exhaust valve of number 3 cylinder is fully open.
- 5** Set the valve tip clearance of number 1 cylinder inlet valve to 0,631 mm (0.025 in).
- 6** Turn the crankshaft, clockwise from the front, until the push rod for number 1 cylinder inlet valve just tightens. In this position, check if the mark on the crankshaft pulley is within  $2\frac{1}{2}^{\circ}$  of the pointer.  
 $2\frac{1}{2}^{\circ}$  is 3,5 mm (0.14 in) at the circumference of the standard pulley, that has a diameter of 163,2 mm (6.43 in).
- 7** If the timing is more than  $2\frac{1}{2}^{\circ}$  out of position, the timing gears are probably not in correct mesh.
- 8** One tooth on the camshaft gear is equivalent to 20.5 mm (0.81 in) of pulley circumference for a pulley of 163,2 mm (6.43 in) diameter.
- 9** Turn the crankshaft, clockwise from the front, until the inlet valve of the rear cylinder is fully open. Set the valve tip clearance of the inlet valve of number 1 cylinder to 0,20 mm (0.008 in).
- 10** Fit the rocker cover, see Operation 3-1.
- 11** Remove the temporary pointer from the timing case and the timing mark from the pulley.

To check the locking angle of the fuel injection pump timing

**Operation 8-3**

**Special requirements**

Special tools			
Description	Part number	Description	Part number
Universal timing tool	21825610	Drive adaptor	21825513

**Caution:** This procedure must be followed carefully if:

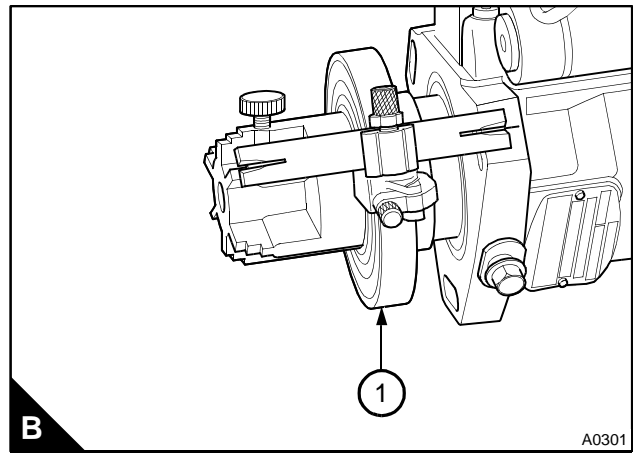
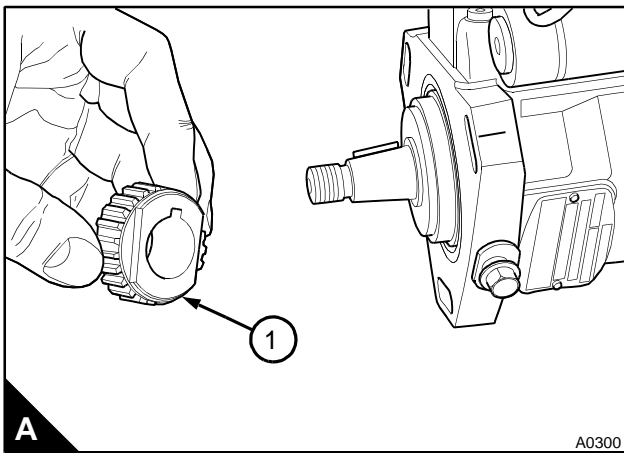
- The engine performance is not correct
- The locking screw is released after the pump is removed from the engine.

**Note:** The fuel pump code letters for the 900 Series locked pumps are either AN or BN.

1 Remove the fuel injection pump from the engine, see Operation 11-14.

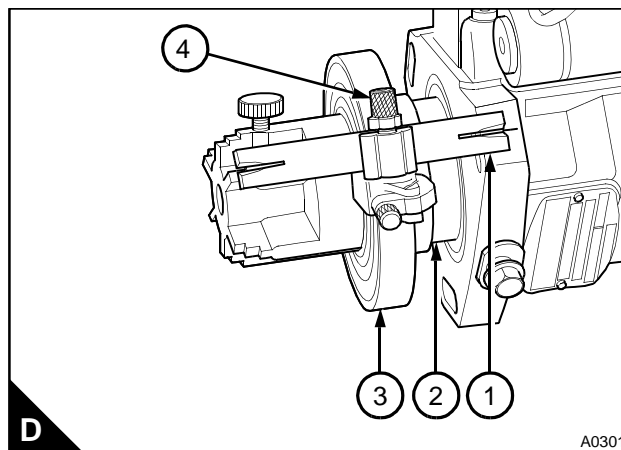
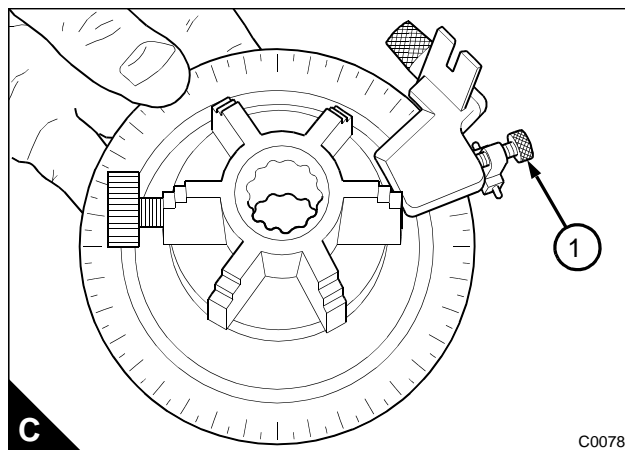
**Caution:** When the pump is held, do not apply pressure to the alloy components.

2 Hold the pump securely in a vice. Fit the adaptor (A1) for the timing tool (B1) to the drive shaft of the pump. Use the nut for the drive gear to retain the adaptor, tighten the nut finger tight.



*Continued*

- 3 Loosen the locking screw (C1) on the timing tool and set the tool to 88° for pump code letters AN and BN. Tighten the locking screw. These angles are locking angles.
- 4 Fit the timing tool together with the spacer (D2), to the adaptor on the pump.
- 5 Release the locking screw (D4) and slide the pointer (D1) forward until it is over the centre of the pump flange then tighten the locking screw. Check that the mark on the pump flange is in the centre of the slot in the pointer.
- 6 If the mark is not correct, remove the timing tool and the adaptor. Remove the pump to the nearest Perkins distributor to have the pump checked. If the mark is correct, remove the timing tool and the adaptor from the pump.
- 7 Fit the fuel injection pump, see Operation 11-15.



## To check the timing of pin-timed fuel injection pumps

## Operation 8-4

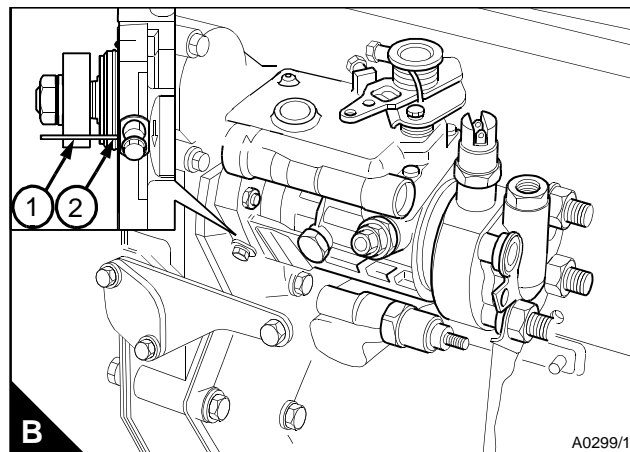
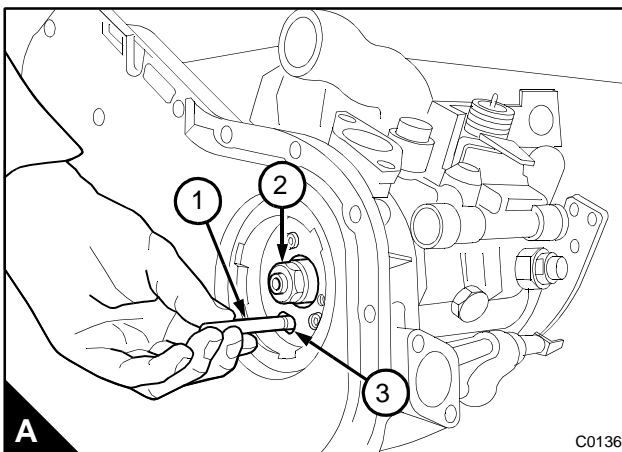
## Special requirements

Special tools			
Description	Part number	Description	Part number
Timing pins for Delphi and Stanadyne fuel injection pumps	27610033	Locking pin for the crankshaft	21836001

**Caution:** Do not remove the nut (A2) from the shaft of the fuel injection pump. The fuel pump hub is fitted to the shaft in the factory to ensure that the fuel pump is in the correct position for timing. If the hub is removed, the hub will need to be accurately fitted to the pump by use of special equipment available to Perkins distributors.

- 1 Remove the cover for the fuel injection pump gear.
- 2 Set the piston of number 1 cylinder to TDC on the compression stroke, see Operation 8-1.
- 3 Insert the timing pin (A1) through the slot (A3) in the fuel pump gear and the hole in the hub (B1). Push the pin fully into the recess (B2) in the body of the fuel pump. If the pin can be fully inserted then the pump timing is correct. There should be no resistance when the pin is inserted.
- 4 If the timing pin cannot be pushed into the pump body, check that the engine is correctly set at TDC on the number 1 cylinder compression stroke, see Operation 8-1.
- 5 If the engine is set correctly at TDC but the pin does not fit into the hole, the fuel pump must be removed and set by a specialist.
- 6 If the engine is correctly set, remove the timing pin and fit the gear cover of the fuel injection pump back onto the timing case.

**Caution:** Remove the pin from the flywheel and the backplate.



# 9

## Aspiration system

### General description

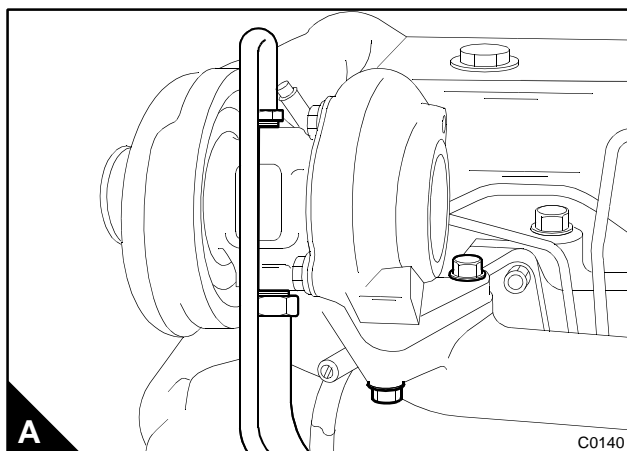
**Warning!** Turbochargers operate at high speeds and at high temperatures. Keep fingers, tools and debris away from the inlet and outlet ports of the turbocharger. Do not touch hot surfaces.

The Schwitzer S1B turbocharger (A), is fitted between the exhaust and the induction manifolds and is driven by exhaust gases. Air is supplied to the engine at more than atmospheric pressure. The turbocharger is lubricated by oil from the filter head. The oil passes through the bearing housing of the turbocharger and returns to the lubricating oil sump.

Some engines have the turbochargers mounted towards the front of the engine or centrally according to the application it is fitted to.

Always use the manufacturer's instructions and specialist assistance to fit the service kit for the turbocharger.

**Caution:** Do not use a caustic solution to clean the components of the turbocharger because the turbocharger will be damaged.



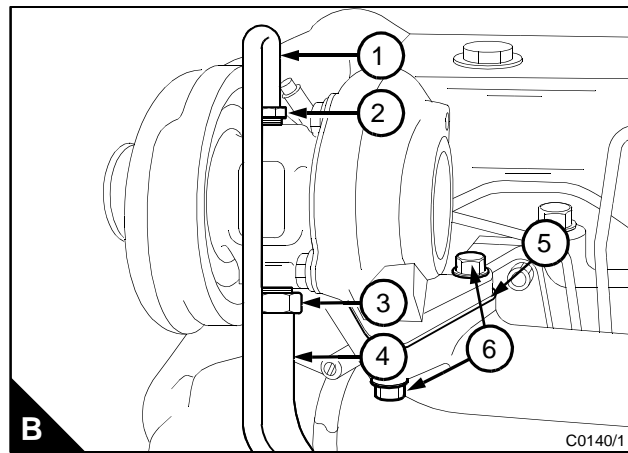
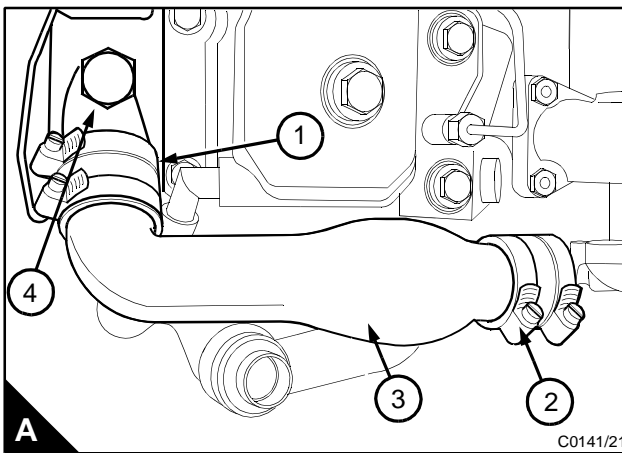
## Turbocharger

To remove

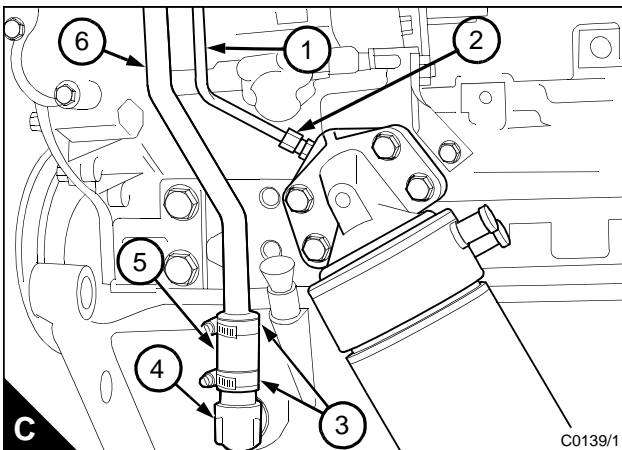
### Operation 9-1

**Warning!** Turbochargers operate at high speed and at high temperatures. Keep your fingers, tools and debris away from the inlet and outlet ports of the turbocharger and prevent contact with hot surfaces

- 1 Thoroughly clean the turbocharger with a non caustic cleaner.
- 2 Remove the air cleaner hose at the compressor inlet.
- 3 Release the hose clips (A1) between the crossover pipe (A3) and the induction manifold (A4). Push the hose on to the crossover pipe.
- 4 Release the hose clips (A2) between the turbocharger compressor outlet and the crossover pipe. Remove the crossover pipe, together with the hose and the hose clips.



- 5 Release the union connection (B2) on the oil supply pipe (B1) at the top of the bearing housing. On the lower section of the oil supply pipe (C1); use a spanner to hold the union adaptor at the oil filter head adaptor and release the union nut (C2). Remove the oil supply pipe.
- 6 Release the union nut (B3) of the oil drain pipe (B4) at the bottom of the bearing housing of the turbocharger.
- 7 Release the hose clip(s) (C3) between the oil drain pipe and the sump elbow (C4). Push the hose (C5) up the oil drain pipe (C6) and remove the oil drain pipe from the elbow.



Continued