

To check the timing mark of the fuel injection pump

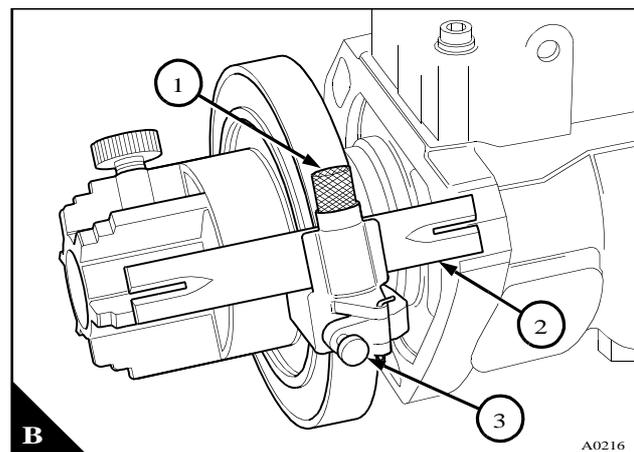
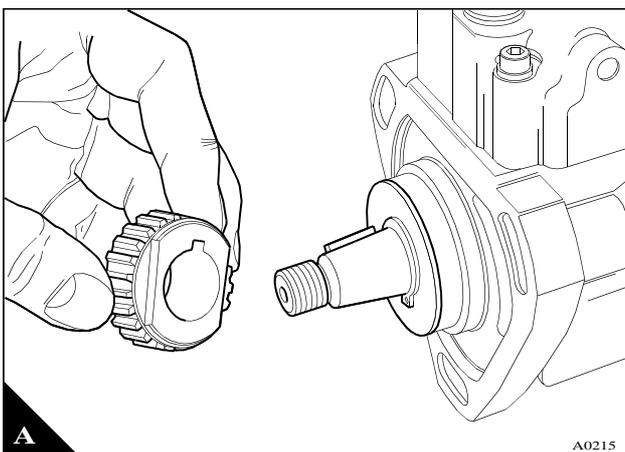
Operation 8-6

Special requirements

Special tools			
Description	Part number	Description	Part number
Pump timing gauge	21825626	Gear adaptor for use with 21825610	21825513
Universal timing gauge	21825610		

Note: Only early Bosch EPVE pumps have a mark on the flange. The mark was removed when the locking screw was introduced.

- 1 Remove the fuel injection pump, see Operation 11-14.
- 2 Fit the adaptor 21825513 to the drive shaft of the fuel pump (A) and fasten it with the nut of the fuel pump gear.
- 3 Release the screw (B3), set the timing tool to the correct angle, see "Engine timing (Bosch EPVE fuel injection pump)" on page 43, and tighten the screw.
- 4 Fit the timing tool to the splined adaptor on the fuel pump drive. Release the screw (B1), slide the pointer (B2) forward until it is over the centre of the fuel pump flange and tighten the screw. Rotate the timing tool and the pump shaft to align the master spline with the number 1 outlet of the pump (outlet "C").
- 5 Remove the plug and the washer from the centre of the rear of the fuel pump and fit the adaptor 21825626. Fit a dial gauge to the adaptor and set the gauge to indicate approximately 2,0 mm (0.080 in).
- 6 With the fuel injection pump held securely, rotate the tool and the drive shaft counter-clockwise, from the drive end, and set the dial gauge to zero when the pump plunger is at its lowest position. Keep the fuel pump secure and rotate the drive shaft clockwise until the gauge indicates 1,0 mm (0.039 in) plunger lift. At this position the slot in the pointer of the timing tool must align with the mark on the flange of the fuel pump.
- 7 If the mark is not correct, remove the timing tool and eliminate the mark on the flange. Fit the timing tool and repeat the above operation to obtain 1,0 mm (0.039 in) plunger lift. With the fuel injection pump and timing tool held securely in the correct position, make a new mark on the flange of the fuel pump, within the slot of the pointer. Release the timing tool and repeat the operation to check that the new mark is correct.
- 8 Remove the timing tool, splined adaptor and the adaptor and dial gauge. Fit the washer and plug to the rear of the fuel pump.
- 9 Fit the fuel injection pump, see Operation 11-15.
- 10 Eliminate air from the fuel system, see Operation 11-25.



To check the engine timing mark

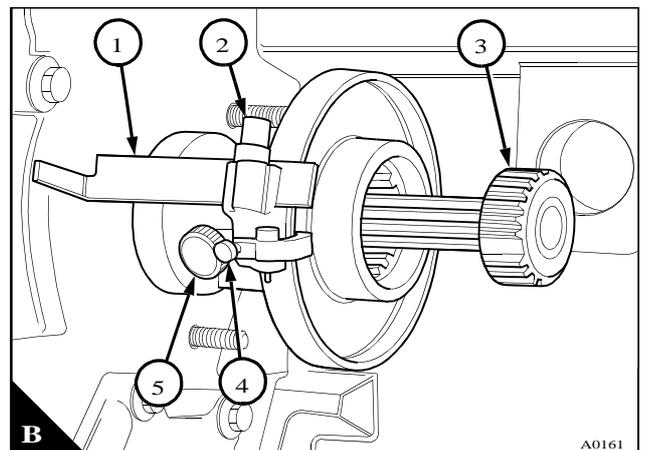
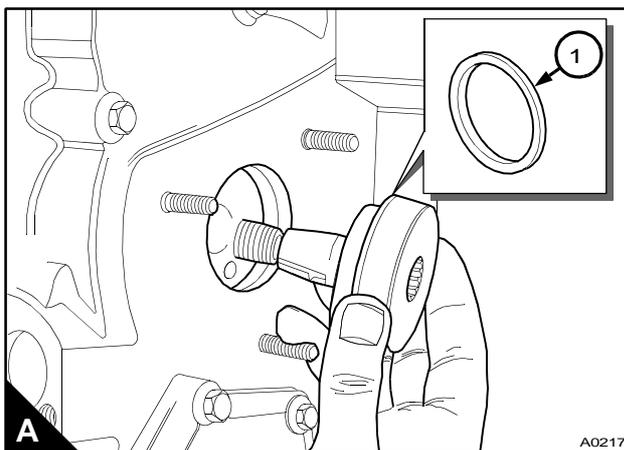
Operation 8-7

Special requirements

Special tools			
Description	Part number	Description	Part number
Universal timing tool	21825610	Pointer for use with 21825610	21825514
Drive adaptor for use with 21825610	21825512	Distance piece for use with 21825610	21825515

Note: The mark was removed from the timing case when the Bosch EPVE pump with a locking screw was introduced.

- 1 Set the piston of number 1 cylinder to TDC on the compression stroke, see Operation 8-1.
- 2 Remove the fuel injection pump and its joint, see Operation 11-14.
- 3 Fit the distance piece 21825515 (A1) to the timing tool adaptor 21825512. Align the key in the adaptor with the keyway in the gear of the fuel pump and fit the adaptor to the gear (A). Ensure that the distance piece is against the rear face of the timing case. Secure the adaptor to the gear with the nut supplied with the adaptor.
- 4 Loosen the screw (B4) on the timing tool 21825610. Set the timing tool to the correct engine check angle, see "Engine timing (Bosch EPVE fuel injection pump)" on page 43, and tighten the screw. Loosen the screw (B5) and fit the splined shaft (B3) into the timing tool (B). Loosen the screw (B2). Fit the 90° pointer 21825514 (B1) and tighten the screw.
- 5 Fit the splined shaft of the timing tool to the adaptor. Slide the timing tool along the splined shaft until it is against the adaptor and tighten the screw (B5).
- 6 Loosen the screw (B2). Slide the pointer forward until the flat face is against the rear face of the timing case and tighten the screw. If the mark on the timing case is correct, the mark will align with the top edge of the pointer (B1). If the mark is not correct, remove the timing tool and eliminate the mark on the timing case. Fit the timing tool. Ensure that the pointer is against the timing case and make a new mark on the timing case along the top straight edge of the pointer.
- 7 Remove the timing tool and the adaptor.
- 8 Fit the fuel pump together with a new joint, see Operation 11-15.
- 9 Remove the dial test indicator from the cylinder head and fit the valve springs and the rocker lever. Set the valve tip clearance of number 1 cylinder inlet valve to 0,20 mm (0.008 in).
- 10 Fit the rocker cover, see Operation 3-2.
- 11 Eliminate air from the fuel system, see Operation 11-25.



To check the timing of the pin timed fuel injection pump

Operation 8-8

Special requirements

Special tools			
Description	Part number	Description	Part number
Timing pin Bosch fuel injection pumps	27610032	Timing pin Lucas/Delphi and Stanadyne fuel injection pumps	27610033

Caution: Do not remove the nut (A2) which retains the hub (A4) to the shaft of the fuel injection pump. The hub is fitted permanently to the shaft. If the hub is moved, it will be necessary for a fuel injection pump specialist to correctly position the hub on the shaft with special test equipment available to Perkins distributors.

1 Set the piston of number 1 cylinder to TDC on the compression stroke, see Operation 8-1 or Operation 8-2.

2 Remove the gear cover from the cover of the timing case. For gear driven coolant pumps: Remove the coolant pump:

Note: On the latest engines with belt driven coolant pumps, four tamper proof fasteners retain the fuel pump gear. Special tools and personnel with the correct training are necessary to remove these fasteners, refer to your nearest Perkins distributor.

3 Insert the timing pin (A1) through the hole (A5) in the fuel pump gear and the slot of the hub (A4). Push the pin fully into the hole (A3) 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.

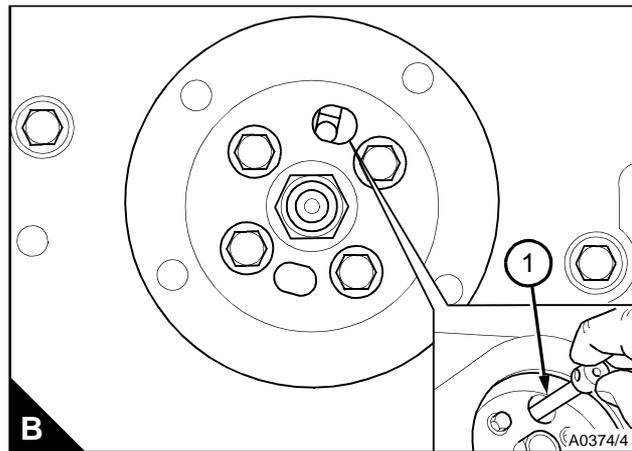
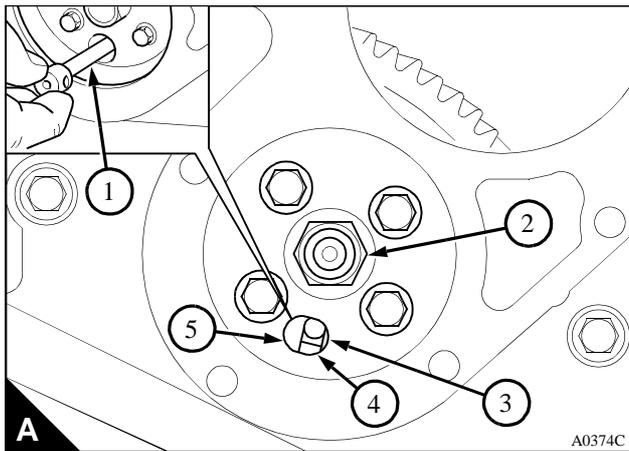
Note: The position for the timing pin for Lucas/Delphi and Stanadyne fuel injection pumps is (A1). The position for the timing pin for Bosch EPVE fuel injection pumps is (B1).

4 Remove the timing pin.

5 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 or Operation 8-2.

If the engine is set correctly at TDC on the number 1 cylinder compression stroke, but the pin does not fit into the hole, the fuel pump must be removed and set by a specialist.

6 Fit the gear cover to the cover of the timing case. For gear driven coolant pumps. Fit the coolant pump:



Engines fitted with Bosch MW in-line fuel injection pumps

General description

The timing gears are stamped with timing marks to ensure that they are assembled correctly (A). The stamped teeth of the crankshaft and camshaft gears will be in mesh 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 in mesh, in this position, because of the different speeds at which the gears rotate.

There are no timing marks on the fuel pump gear of engine types AE and YE. The gear, which is fastened to a hub on the drive shaft of the fuel injection pump, has slots to allow adjustment to the timing.

A data plate is fitted to the pump. An example of the information shown on the plate (B) is:

- Perkins part number (1)
- Fuel pump code (2)
- Maximum engine no load speed (3)
- High idle reset speed (4)

Notes:

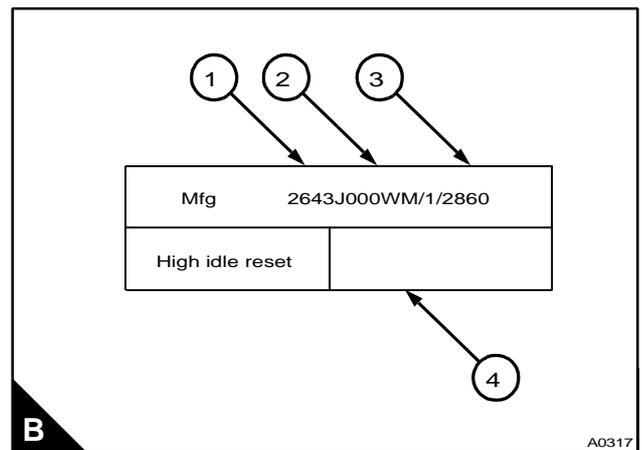
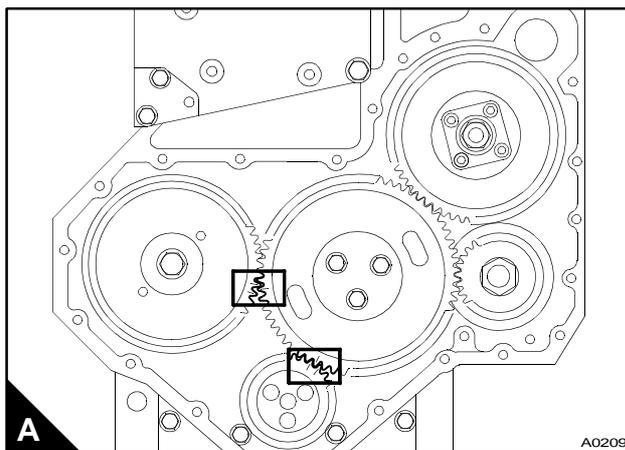
- The maximum no load speed (B3) set by Perkins may be reset by the equipment manufacturer. If the speed is changed the new speed is shown in the high idle reset position (B4). The original maximum no load speed should be removed from the label.
- The adjustment screw for the maximum no load speed, is sealed by the manufacturer. The setting must not be changed, unless approved, as it could affect the warranty of the engine.

For details of the fuel pump code for the engine, see "Engine timing (Bosch EPVE fuel injection pump)" on page 43.

Standard operations

To set number 1 piston to TDC on the compression stroke, see Operation 8-1.

To check the valve timing, see Operation 8-3.



To check the timing of the fuel injection pump

Operation 8-9

Special requirements

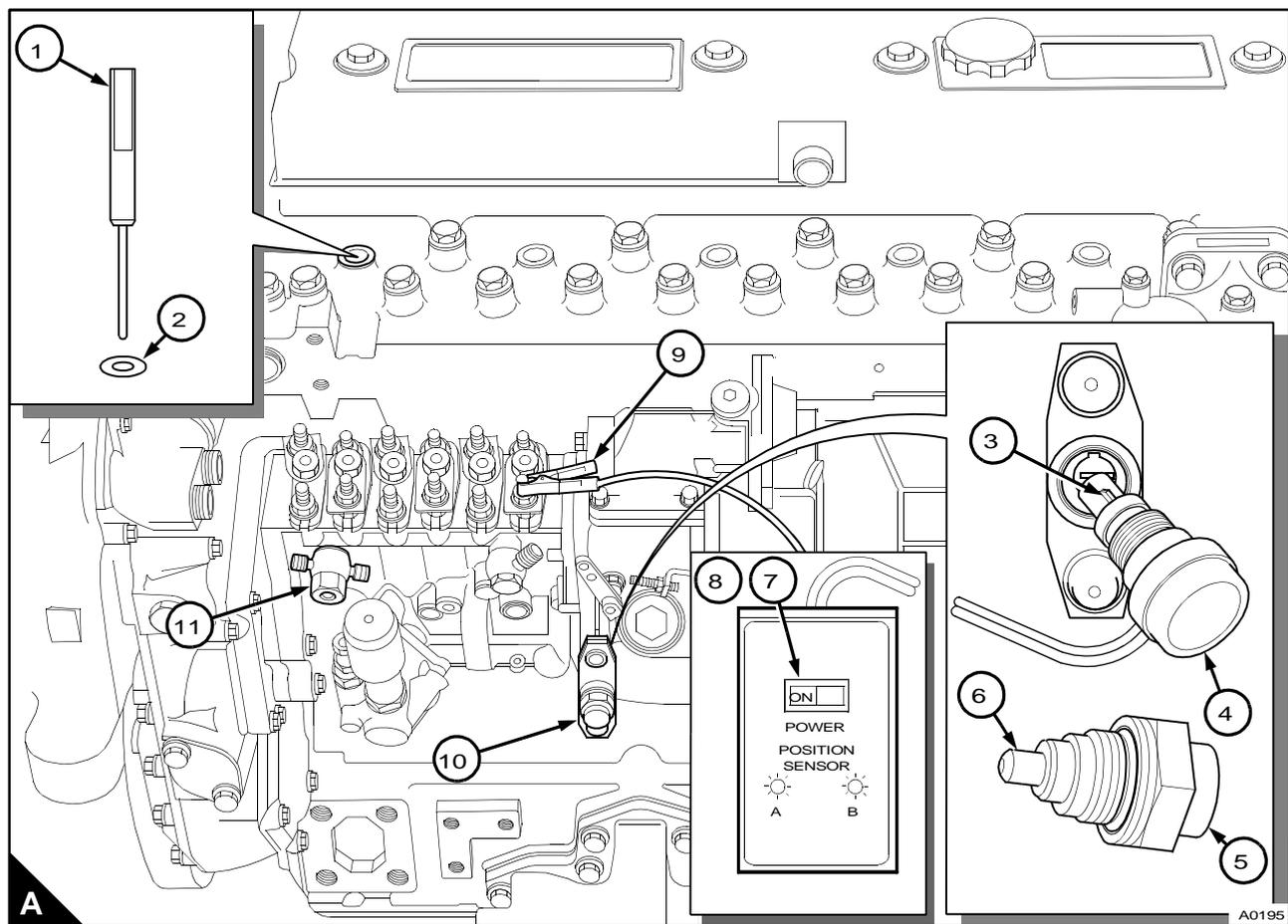
Special tools			
Description	Part number	Description	Part number
Piston replacer tool	21825615	Timing light	KJ37007

- 1 Remove the rocker cover, see Operation 3-1.
- 2 Loosen the setscrews which retain the atomisers.
- 3 Rotate the crankshaft clockwise, from the front, until the push rod for the inlet valve of number 1 cylinder just releases.

Note: A locally made washer (A2) must be fitted onto the piston position probe (A1) when the engine check angle is less than 100° BTDC. See "Engine timing (Bosch in-line fuel injection pump)" on page 44 for details.

- 4 Remove the atomiser from number 1 cylinder together with its seat washer and put the piston position probe, 21825630 or 21825947, (A1) in its place. Fit the atomiser clamp to the probe and tighten the setscrews gradually and evenly.

- 5 Remove the cap (A5) and its washer from the timing attachment (A10) on the governor housing. Ensure that the plastic pin (A6) in the cap is not lost. Put the probe (A4) of the timing light, KJ37007, (A8) into the timing attachment. Ensure that the spline (A3) on the probe is at the top and enters the slot in the timing attachment. Tighten the outer body of the probe. Connect the earth cable (A9) to the engine in a place where there will be a good earth connection. Press the switch (A7) on the timing light to the "ON" position.



Continued

Caution: *Ensure that the piston comes lightly into contact with the piston position probe, or both the piston and the probe could be damaged.*

6 Very carefully rotate the crankshaft clockwise until the piston just comes into contact with the piston position probe.

7 The timing is correct when the two lamps on the timing light are illuminated.

If both of the lamps are not illuminated, release the setscrews and remove the gear cover from the timing case cover. Loosen the cap screws which retain the fuel pump gear. Adjust the position of the fuel injection pump hub until both lamps are illuminated. Tighten the cap screws to 35 Nm (26 lbf ft) 3,6 kgf m.

8 To check the timing is correct, rotate the crankshaft counter-clockwise, from the front of the engine to move the piston away from the probe and repeat steps six and seven above.

9 Press the switch on the timing light to the "OFF" position. Disconnect the earth cable from the engine. Release the outer body of the probe and remove the probe from the timing attachment and remove the timing light.

10 Check that the brass end of the plastic pin can be seen in the cap for the timing attachment. Fit the cap together with a new washer.

Caution: *If the plastic pin is not put into the cap correctly, damage could occur to the fuel injection pump.*

11 Release the setscrews and remove the piston position probe from number 1 cylinder. Fit the atomiser together with a new seat washer. Tighten the setscrews for all of the atomisers gradually and evenly to 12 Nm (9 lbf ft) 1,2 kgf m.

12 Fit the gear cover together with a new joint to the timing case cover. Clean the threads of the setscrews for the gear cover and apply a sealant to the threads. Fit the setscrews and tighten them.

13 Fit the rocker cover, see Operation 3-2.

Engines fitted with Lucas/Delphi DPA and DPS fuel injection pumps

General description

The timing gears are stamped with timing marks to ensure that they are assembled correctly (A). The stamped teeth of the crankshaft, camshaft and fuel pump gears will be in mesh 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 in mesh in this position, because of the different speeds at which the gears rotate.

The fuel pump gear has timing marks for four and six cylinder engines. Also the gear is stamped with the letter "C" where a Lucas/Delphi fuel pump is fitted. The letter "M" is stamped on the fuel pump gear to indicate that the threads for the screws of the gear puller are metric.

A data plate is fitted to the side of the pump. An example of the information shown on the plate (B) is:

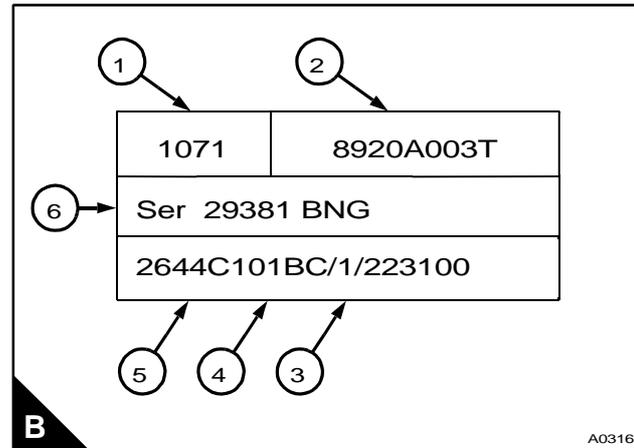
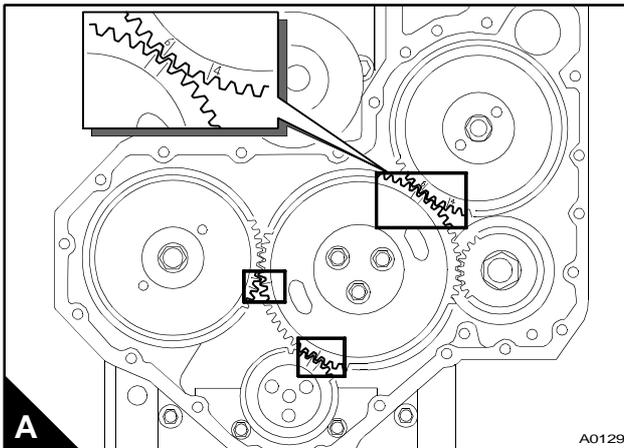
- Manufacturers model number (1)
- Manufacturers description number (2)
- Maximum engine no load speed (3)
- Fuel pump code letters (4)
- Perkins part number (5)
- Fuel pump serial number (6)

For details of the fuel pump code letters for the engine, see "Engine timing (Lucas CAV/Delphi DPA and DPS) fuel injection pump" on page 45.

Standard operations

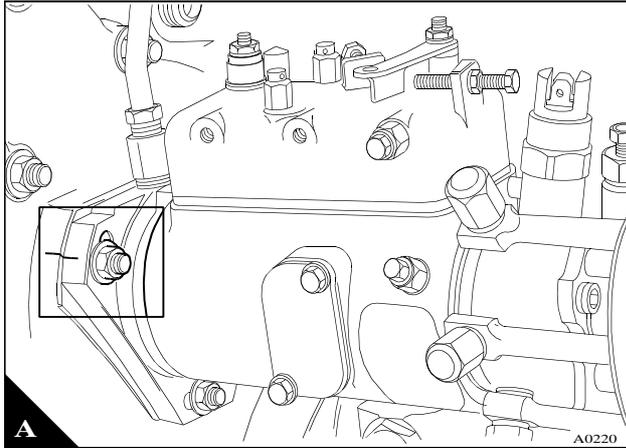
To set number 1 piston to TDC on the compression stroke, see Operation 8-1 or Operation 8-2.

To check the valve timing, see Operation 8-3.



To check the timing of the fuel injection pump**Operation 8-10**

If the mark on the flange of the fuel injection pump is in line with the mark on the timing case (A), the timing of the fuel injection pump should be correct. If the timing marks are in line and the engine performance indicates that the timing is not correct, check that the marks on the flange and on the timing case are in their correct positions, see Operation 8-11 and Operation 8-12.



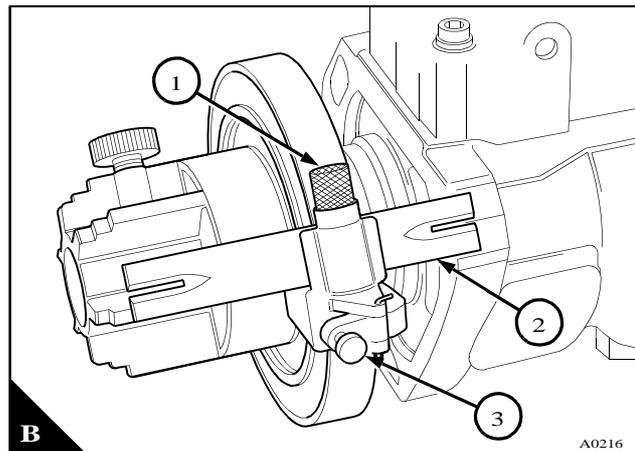
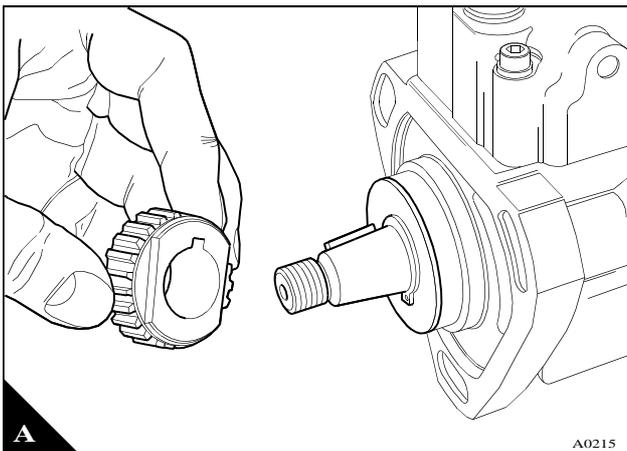
To check the timing mark of the fuel injection pump

Operation 8-11

Special requirements

Special tools			
Description	Part number	Description	Part number
Universal timing tool	21825610	Gear adaptor for use with 21825610	21825513

- 1 Remove the fuel injection pump, see Operation 11-31.
- 2 Fit the adaptor 21825513 (A) to the drive shaft of the fuel pump and fasten it with the nut of the fuel pump gear.
- 3 Remove the banjo bolt from number 1 high-pressure outlet "W" for four cylinder engines, outlet "Y" for six cylinder engines - and fit a banjo bolt which does not contain a pressure valve.
- 4 Connect number 1 outlet to an atomiser tester. Operate the hand pump until a pressure of 30 atm (440 lbf in²) 31 kgf/cm² is indicated on the gauge.
- 5 Loosen the screw (B3) on the timing tool 21825610 and set the timing tool to the correct angle, see "Engine timing (Lucas CAV/Delphi DPA and DPS) fuel injection pump" on page 45. Tighten the screw.
- 6 Fit the timing tool to the adaptor on the fuel pump drive shaft. Rotate the drive shaft of the fuel pump by hand in the normal direction of rotation -see arrow on pump data plate - until the fuel pressure prevents movement. In this position, the fuel pump is set at the start of injection from number 1 outlet.
- 7 Loosen the screw (B1). Slide the pointer (B2) forward until it is over the centre of the pump flange and check that the mark on the flange is in the centre of the slot in the pointer.
- 8 If the mark is not correct, remove the timing tool and eliminate the mark. Fit the timing tool and ensure that the fuel pump is at the start of injection for number 1 cylinder. Loosen the screw (B1). Slide the pointer forward to the complete width of the flange and tighten the screw. Make a new mark on the flange of the pump through the slot in the pointer.
- 9 Remove the timing tool and the adaptor.
- 10 Disconnect the atomiser tester and fit the original banjo bolt to number 1 high-pressure outlet.
- 11 Fit the fuel injection pump, see Operation 11-32.
- 12 Eliminate air from the fuel system, see Operation 11-35.



To check the engine timing mark

Operation 8-12

Special requirements

Special tools			
Description	Part number	Description	Part number
Universal timing tool	21825610	Pointer for use with 21825610	21825514
Adaptor for use with 21825610	21825512		

- 1 Set the piston of number 1 cylinder to TDC on the compression stroke, see Operation 8-1 or Operation 8-2.
- 2 Remove the fuel injection pump and its joint, see Operation 11-31.
- 3 Align the key in the adaptor 21825512 (A) with the keyway in the gear of the fuel injection pump and fit the adaptor to the gear. Ensure that the adaptor is against the rear face of the timing case. Secure the adaptor to the gear with the nut supplied with the adaptor.
- 4 Loosen the screw (B4) on the timing tool 21825610. Set the timing tool to the correct engine check angle, see "Engine timing (Lucas CAV/Delphi DPA and DPS) fuel injection pump" on page 45, and tighten the screw. Loosen the screw (B5) and fit the splined shaft (B3) into the timing tool (B). Loosen the screw (B2). Fit the 90° pointer 21825514 (B1) and tighten the screw.
- 5 Fit the splined shaft of the timing tool to the adaptor. Slide the timing tool along the splined shaft until it is against the adaptor and tighten the screw (B5).
- 6 Loosen the lock screw (B2). Slide the pointer forward until the flat face is against the rear face of the timing case and tighten the screw. If the mark on the timing case is correct, the mark will align with the top edge of the pointer (B1). If the mark is not correct, remove the timing tool and eliminate the mark on the timing case. Fit the timing tool. Ensure that the pointer is against the timing case and make a new mark on the timing case along the top straight edge of the pointer.
- 7 Remove the timing tool and the adaptor.
- 8 Fit the fuel injection pump and a new joint, see Operation 11-32.
- 9 Remove the dial gauge from number 1 cylinder inlet valve and fit the valve springs and the rocker lever. Set the valve tip clearance of number 1 cylinder inlet valve to 0,20 mm (0.008 in).
- 10 Fit the rocker cover, see Operation 3-2.
- 11 Eliminate air from the fuel system, see Operation 11-35.

