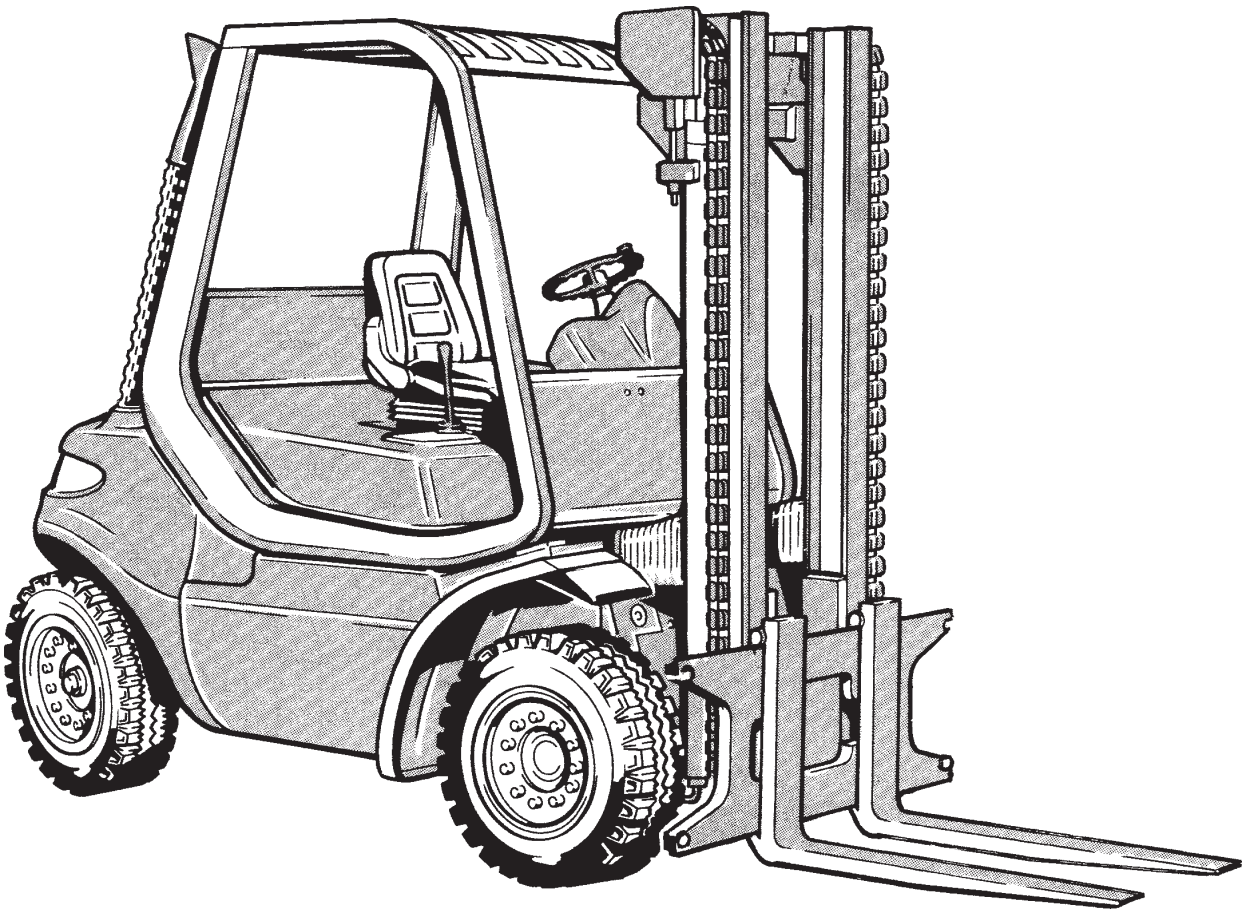
Service Training

Linde IC-Engined Fork Truck
H 35/40/45 D/T
H 35/40/45 D-02
H 35/40/45 D-03/T-03
H 35/40/45 D-04/T-04
Series 352



CONTENTS

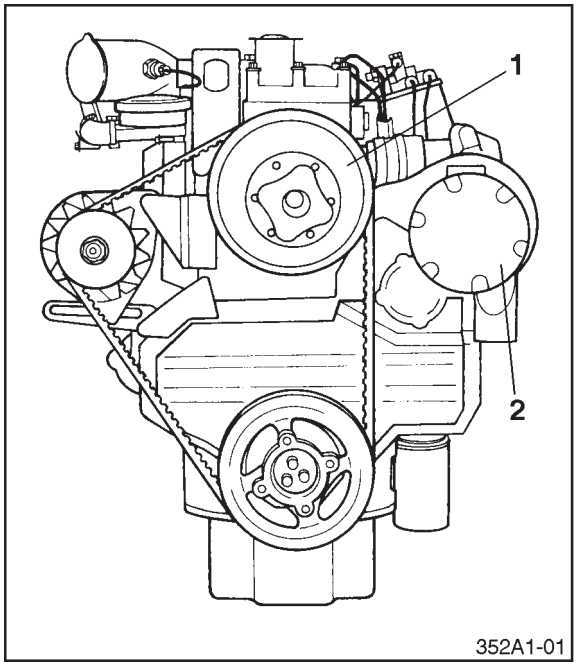
3 IC-ENGINED FORK TRUCK H 35/40/45 D/T, TYPE 352

3.1 ENGINE

3.1.1 ENGINE SPECIFICATIONS (DIESEL)

Engine type	Perkins 1004.4, parts list AA 80427
	Perkins 1004.4, parts list AG 80757
	Perkins 1004.4, parts list AP 80975
Number of cylinders	4
Displacement	4000 cc
Power	50.5 kW at 2100 rpm
Injection pressure	250 bar
Start of injection	17.5° BTDC
Compression ratio	16.5 : 1
Compression pressure	31 bar
Compression	wear limit: 26.0 bar
Maximum difference in pressure	3 bar
Lower idling speed	750 $^{+50}$ rpm
Upper idling speed	2200 $^{+50}$ rpm
Rated speed	2100 rpm
Valve clearance (cold)	inlet 0.20 ± 0.05 mm
	exhaust 0.45 ± 0.05mm
Firing order	1 - 3 - 4 - 2
Cylinder 1	on water pump side
Direction of rotation	anti-clockwise (looking on flywheel)

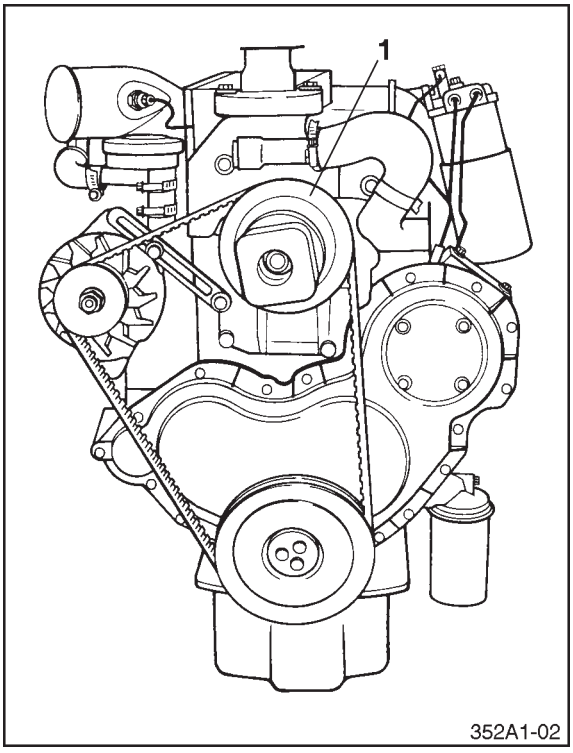
PERKINS 1004.4
PARTS LIST AA 80427



1 Fan pulley
2 Water pump

On engine parts list AA 80427 the water pump is bolted to the timing cover and driven via a gear by the fuel injection pump drive gear. The engine was installed up to 9/94.

PERKINS 1004.4
PARTS LIST AG 80757
PARTS LIST AP 80975



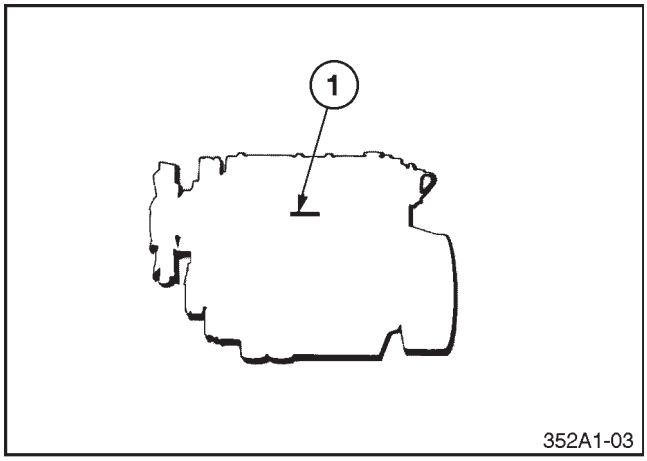
1 Pulley for fan and water pump

On engine parts list AG 80757 the water pump is driven via a V-belt. The engine has been installed since 10/94.
On engine parts list AP 80975 the fuel injection pump and the injection nozzles were changed.

In the following descriptions mention is made of the differences between the various versions.

3.1.2 EXPLANATION OF THE ENGINE NUMBER

The engine number is stamped on a plate mounted on the cylinder block on the fuel injection pump side (1).



A typical engine number is

AA 80427 U 905 928 S

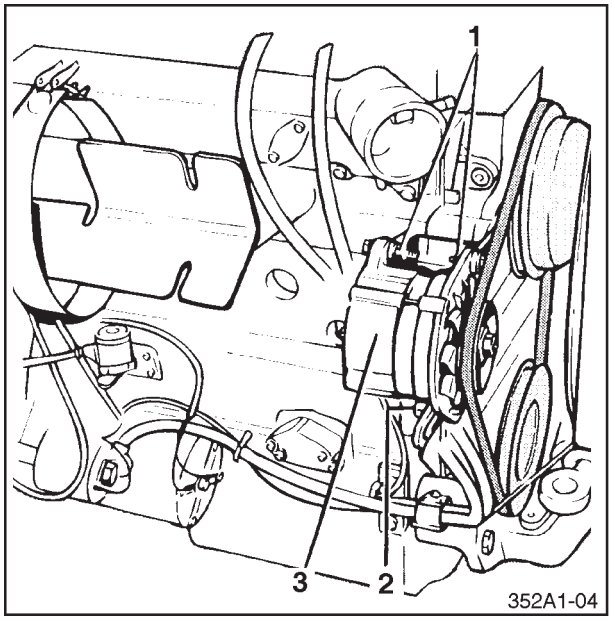
- S — Year built
- 905 928 — Engine series number
- U — Country of manufacture
- 80427 — Engine parts list
- AA — Engine type = 4-cylinder naturally aspirated

If you need repair parts, service or information for your engine, please state the complete engine number.

3.1.3 RENEWING AND TIGHTENING THE V-BELT

RENEWING THE V-BELT

- Slacken both hex nuts (1).
- Slacken the fastening screw (2) on the adjustment link.
- Pivot the alternator (3) towards engine and remove the V-belt.
- Check the pulleys for wear, renewing them if necessary.
- Install a new V-belt.

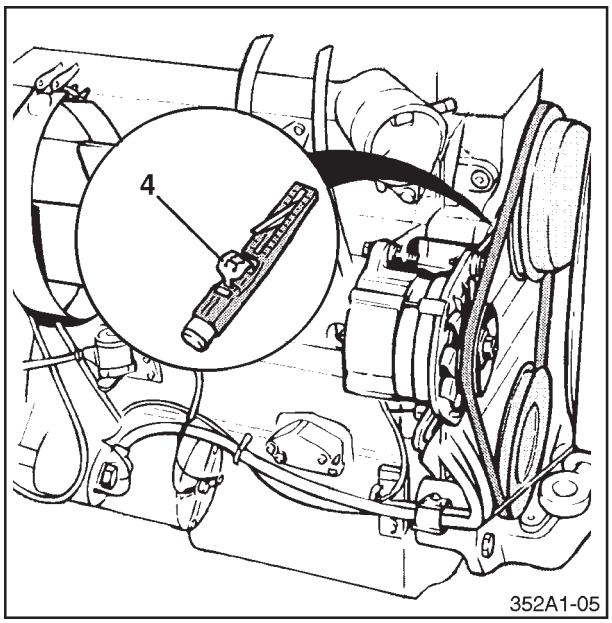


TENSIONING THE V-BELT

When checking belt tension, the use of a belt tension gauge (4), Part No. 000 941 94 35 is recommended.

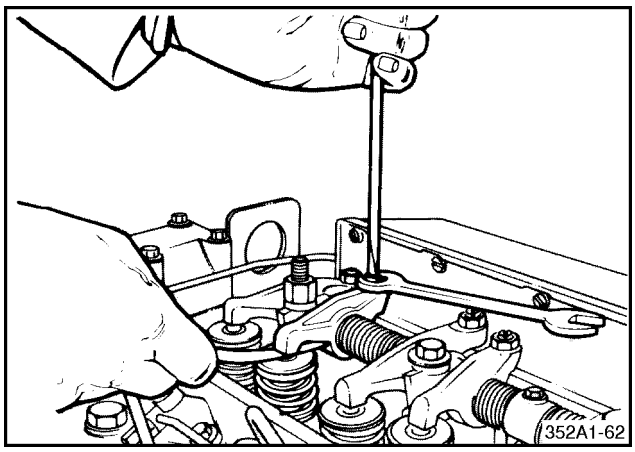
- Pivot the alternator (3) away from the engine until the specified tension is obtained.
- Tighten the hex nuts (3) and fastening screw (2). Specified tension: 250 - 350 N

NOTE: If a gauge is not available, check by pressing down the belt with the thumb and check the deflection. The belt deflection between alternator and fan pulley should be approx. 10 mm.



3.1.4 ADJUSTING THE VALVE CLEARANCE

The valve clearance is measured between the valve stem end and rocker arm. On a cool engine the valve clearance is 0.20 mm at the inlet valves and 0.45 mm at the exhaust valves.

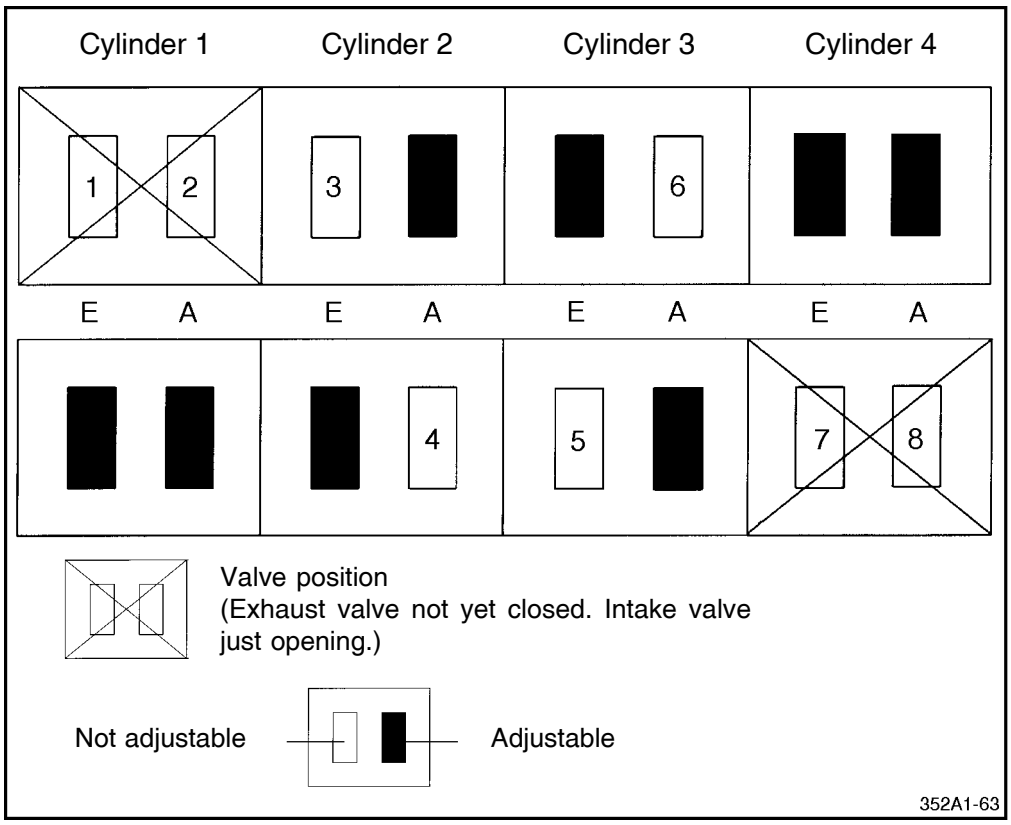


3.1.4.1 VALVE CLEARANCE ADJUSTMENT SCHEMATIC

Crankshaft position I

Crankshaft position II
(rotate the crankshaft through 360°)

E = Inlet valve
A = Exhaust valve



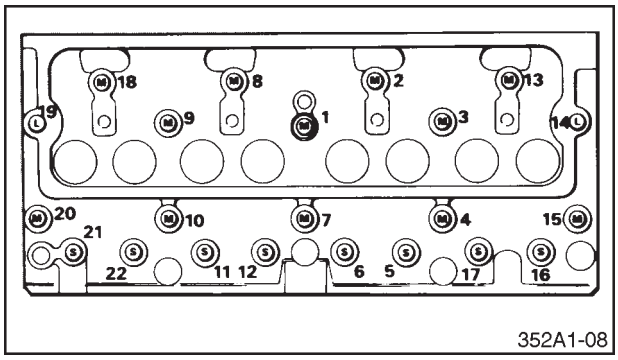
The position of the inlet and exhaust valves are shown in the illustration.

CAUTION: The first cylinder is located on the water pump side.

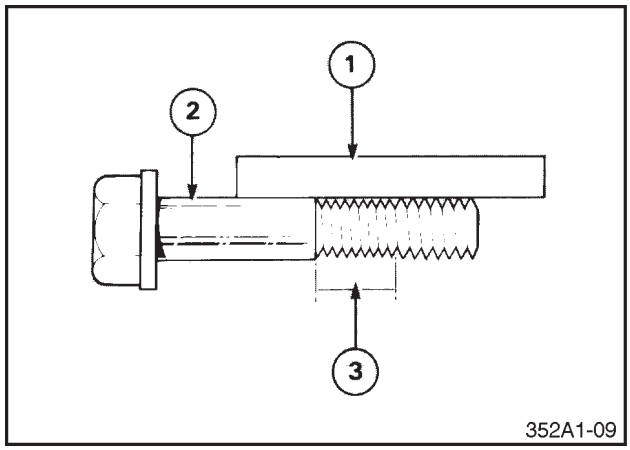
3.1.5 CYLINDER HEAD

3.1.5.1 REMOVING THE CYLINDER HEAD

- Unscrew the cylinder head bolts uniformly and in stages in the reverse order of the sequence given in the schematic.

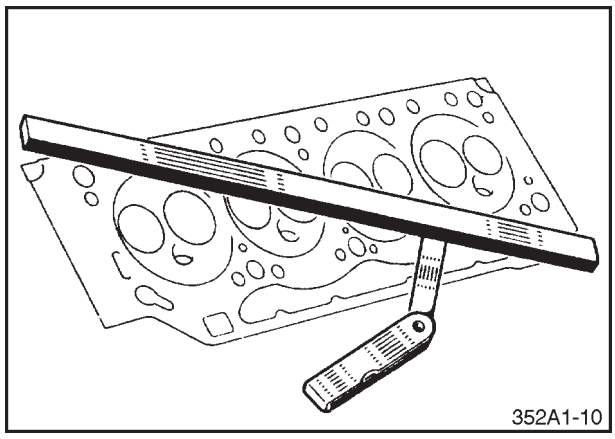


- Check the cylinder head bolts for deformation of the shank (2) with a ruler (1).
- Check the bolts for a visible reduction of the thread gauge in the vicinity of the bolt shank (3).
- Replace deformed or elongated bolts if the inspection of the cylinder head bolt shows that they are not in order.



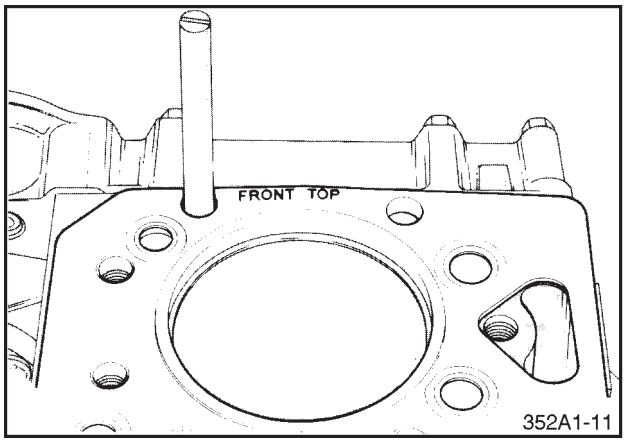
3.1.5.2 INSTALLING THE CYLINDER HEAD

- Clean the cylinder head and engine block mating surfaces. There should be no remnants of the gasket on the mating surfaces.
- Check the cylinder head for deformation with a steel ruler and a set of gauges.
  Maximum longitudinal deformation 0.15 mm
  Maximum transverse deformation 0.08 mm

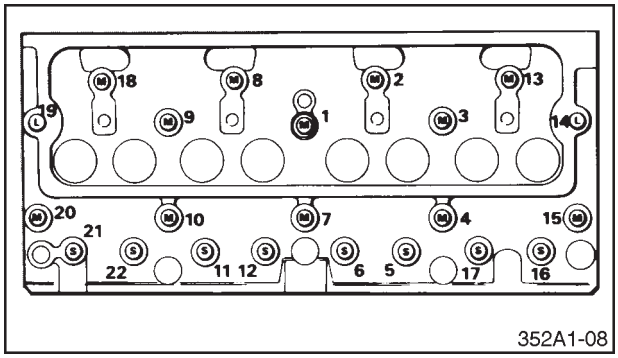


- Fit a new cylinder head gasket without additional sealants.

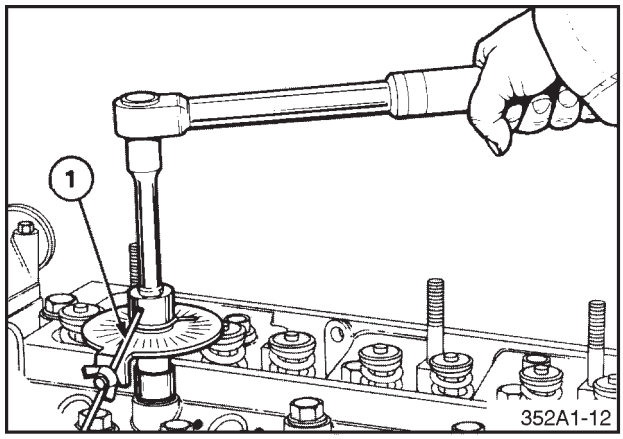
NOTE: Clean the tapped holes in the engine block before assembly of the cylinder head.



- Oil the cylinder head tapholes install bolts and torque to 110 Nm as shown in the schematic.
- Retighten the cylinder head bolts in the order given in the illustration and according to their length:
  Short bolts (S) are tightened a further 150°.
  Medium-sized bolts (M) are tightened a further 180°.
  Long bolts (L) are tightened a further 210°.

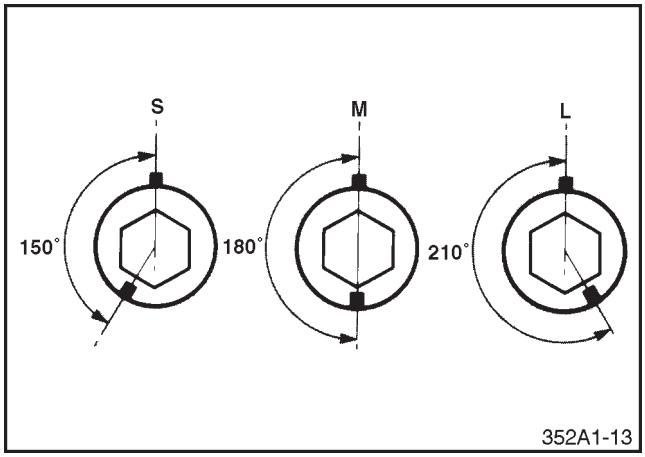


- If an angle gauge (1) is not available, mark the position of each bolt on the cylinder head at a corner.

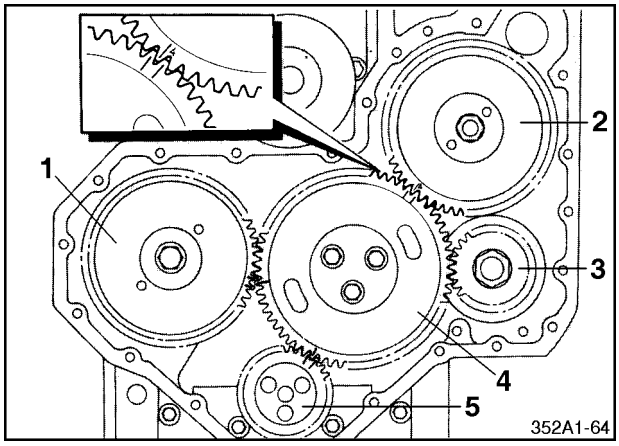


- Mark the correct angle of each bolt on its side (clockwise) according to its length (S, M or L).
- Then tighten the bolts in the correct sequence until they are aligned with the marks on the cylinder head.

NOTE: It is not necessary to tighten the cylinder head bolts when the engine is warm or after 50 service hours.



3.1.6 ENGINE TIMING AND TIGHTENING TORQUES



CAUTION: On 4 cylinder trucks the setting mark "4" must be in line with the mark on the opposite side.

1	Camshaft	78 Nm
2	Fuel injection pump	80 Nm
3	Auxiliary power take-off (option)	130 Nm
4	Intermediate shaft	44 Nm
5	Crankshaft	115 Nm

3.1.7 INJECTION NOZZLES

INJECTION NOZZLE MALFUNCTIONS

NOTE: Defective injection nozzles can cause the following malfunctions:

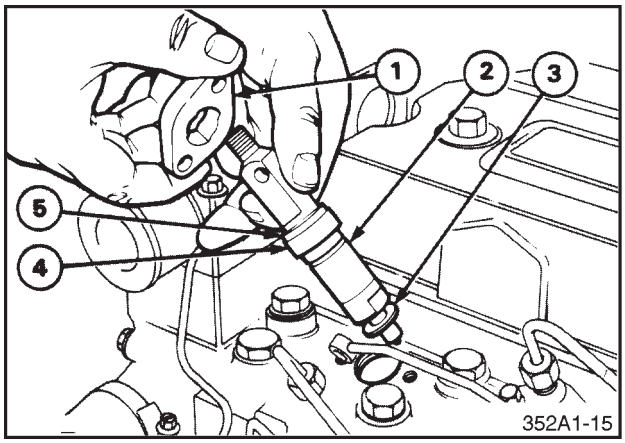
- Misfires
- Knocking in one or more cylinders
- Engine overheating
- Drop in performance
- Too much black smoke
- High fuel consumption
- Too much blue smoke during cold starts

Defective injection nozzles can be found by loosening the union nut of the high-pressure pipes one after the other while the engine is running at fast idle speed. When the union nut of the defective injection nozzle is loosened, it has little or no effect on the engine speed.

3.1.7.1 REMOVING AND INSTALLING THE INJECTION NOZZLES, PARTS LIST AA 80247/AG 80757

REMOVAL

- Disconnect the return oil line.
- Disconnect the high pressure lines.
- Unscrew the nozzle holder flange screws and remove the flange (1) .
- Take the nozzle holder (2) and gasket (3), spacer sleeve (5) and dust seal (4) out of the cylinder head.
  ATTENTION: Always disconnect the set of high pressure lines completely, do not change the shape of the bends.



INSTALLATION

ATTENTION: Always renew the gasket (3) and dust seal (4).

- Install the nozzle holder and sealing washer, dust seal and spacer sleeve in the cylinder head. Fit the flange and tighten the fastening screws to 12 Nm in stages.

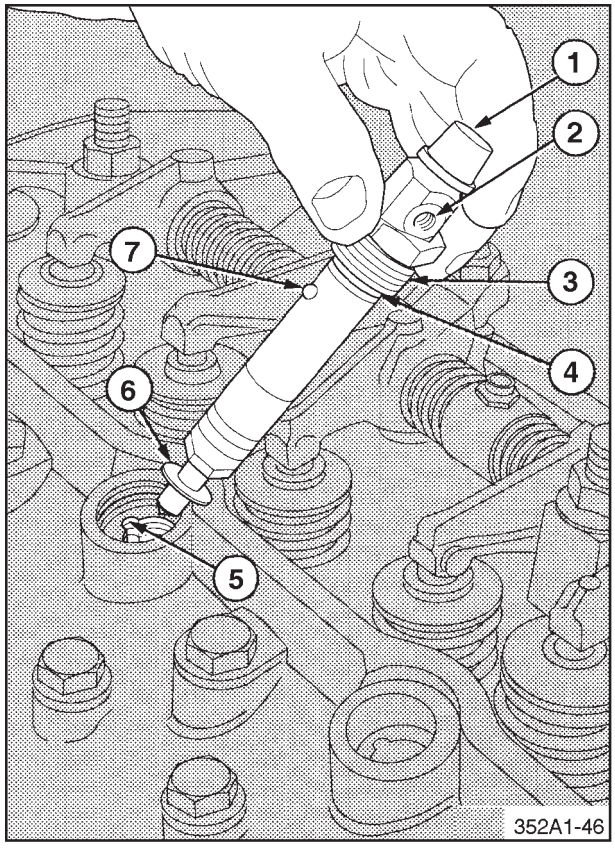
  ATTENTION: Do not cant the nozzle holder.

- Install the high pressure lines and torque union nuts to 18 Nm.
- Reconnect the return oil line. Always renew the return oil line seals.

3.1.7.2 REMOVING AND INSTALLING THE INJECTION NOZZLES, PARTS LIST AP 80975

REMOVAL

CAUTION: It is very important that no dirt gets into the fuel system. Before disconnecting connections, thoroughly clean the area around the connections. After the removal of a part, seal the open connection hole as appropriate**.**



- Disconnect the fuel leak-off pipe from the injection nozzle leak-off (2).
- Remove the union nuts of the injection pipe from the injection nozzle and from the fuel injection pump. Do not bend the pipe. If necessary, remove the pipe clamps. Install a plastic cap (1) to protect the pipe connection and nozzle.
- Unscrew the threaded ring (3) and remove the injection nozzle and seat washer from the bore in the cylinder head.

INSTALLATION

- Carefully clean the thread of the threaded ring (3) and the cylinder head.

CAUTION: Do not allow any thread sealing compound to get below the threaded ring.

- Make sure that the sealing ring (4) is in position. Apply a 2 mm wide bead of POWERPART injection nozzle sealing compound on the first two threads. The bead should go approximately 6 mm around each thread. Do not allow any sealing compound to get on the injection nozzle holders.

CAUTION: Remove and discard the old seat washer (6). If the old seat washer remains in the bore for the injection nozzle, adding a new seat washer will result in the nozzles not being screwed in far enough.

- Place a new seat washer (6) into the bore in the cylinder head.
- Position the injection nozzle and make sure that the fitting ball (7) is seated correctly in the groove (5). Carefully screw in the threads of the threaded ring (3) into the threads of the cylinder head bore.

CAUTION: After tightening the nozzles, do not turn them again as this might destroy the sealing joint produced during tightening and result in a leak at the seat of the injection nozzle.

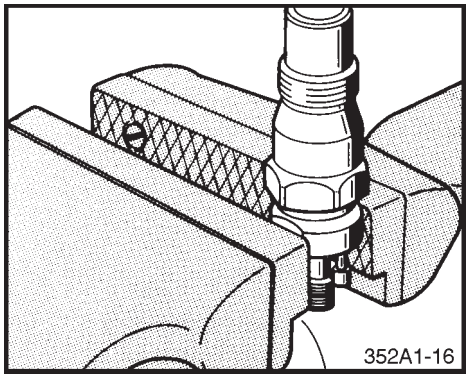
- Tighten the nut gradually and uniformly to a torque of 30 Nm (3.0 kgf m). When tightening the nut, the injection nozzle will turn clockwise as the ball moves in the groove; this is acceptable. Remove any excessive thread sealing compound.

CAUTION: Do not exceed the recommended torque for the union nuts on the injection pipes. In case a leak occurs at the union nut, ensure that the pipe is correctly aligned to the injection nozzle inlet. Do not tighten the injection nozzle union nut further as this could reduce the diameter at the end of the pipe, which in turn could reduce the fuel supply.

- Remove the plastic cap (1), install the injection pipe and torque the union nuts to 22 Nm (2.2 kgf m). If necessary, fit the pipe clamps.
- Renew the washers and fit the fuel leak-off pipe to the leak-off port (2). Torque the banjo fitting to 9.5 Nm (1.0 kgf m).
- Operate the engine and check for fuel and air leaks.

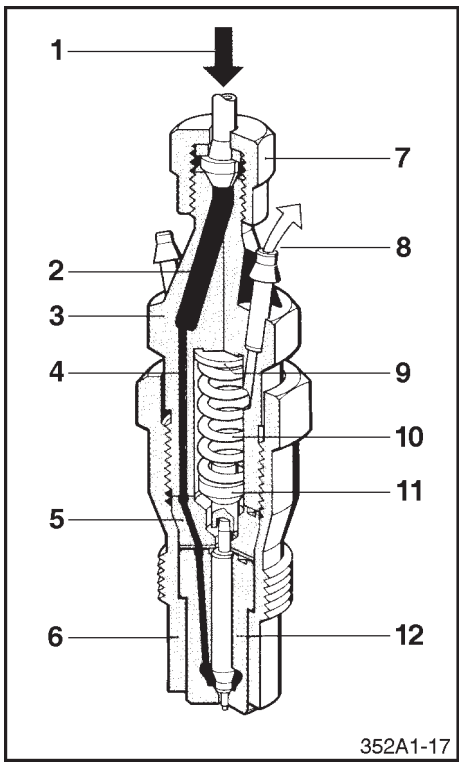
3.1.7.3 REPAIRING THE INJECTION NOZZLES

- Clamp the top part of the nozzle holder in a vice and unscrew it.
- To prevent the parts from falling apart, clamp the lower part of the injection nozzle and disassemble the injection nozzle.
- When disassembling the injection nozzle, take care that the individual parts are not interchanged. Torque for the top and lower part of the injection nozzle = 80 Nm



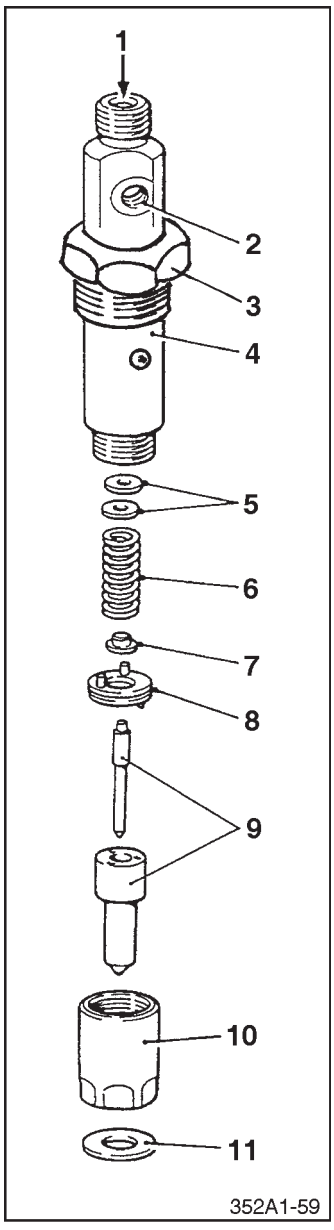
INJECTION NOZZLE

Parts list



1 Fuel inlet
2 Edge-type filter
3 Nozzle holder (atomiser)
4 Pressure passage
5 Shim
6 Nozzle tightening nut
7 Union nut for high-pressure pipe
8 Fuel leak-off
9 Pressure adjustment shims
10 Compression spring
11 Pressure spindle
12 Injection nozzle

Parts list



1 Fuel inlet
2 Fuel leak-off
3 Tightening nut
4 Nozzle holder (atomiser)
5 Pressure adjustment shims
6 Compression spring
7 Spring seat
8 Shim (adaptor)
9 Injection nozzle
10 Nozzle tightening nut
11 Seat washer