Sisudiesel

320, 420, 620, 634

engines

Workshop Manual

01 02

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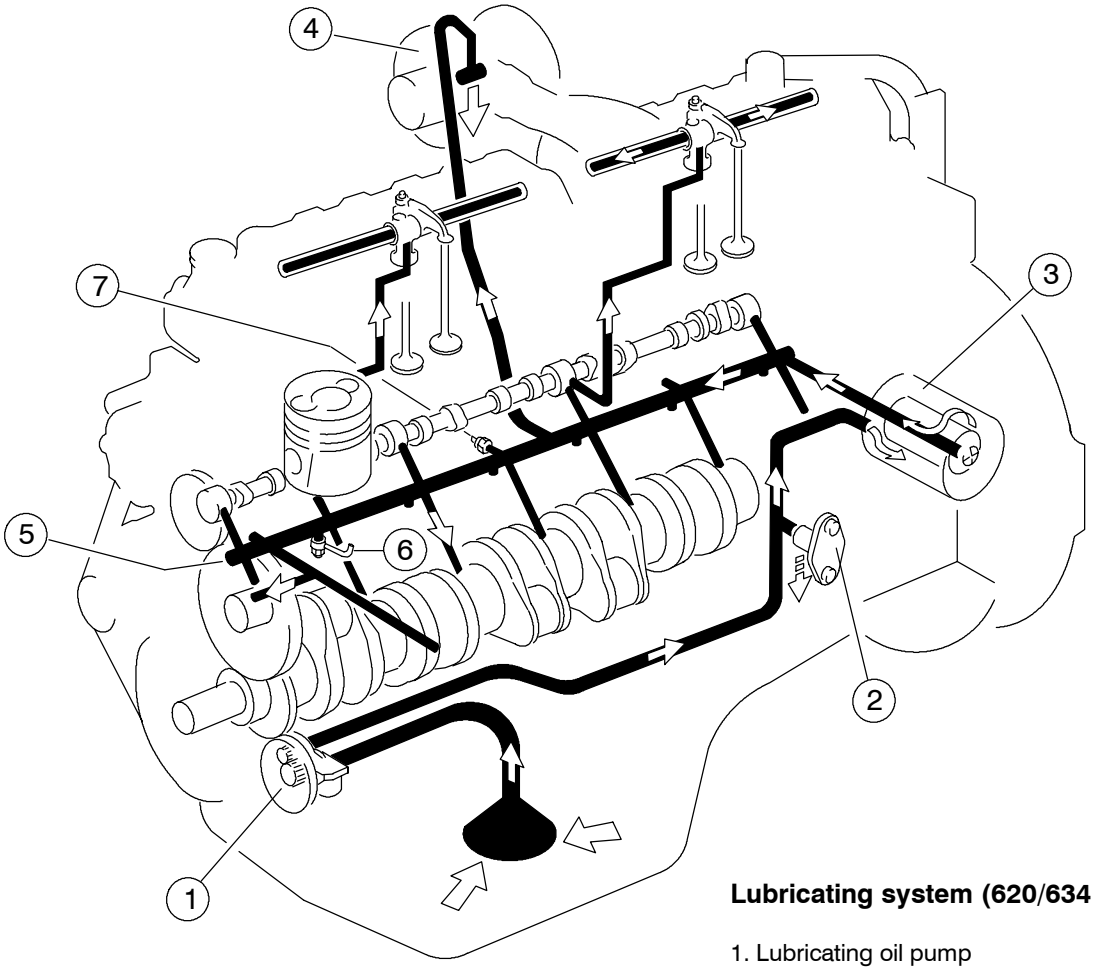
Valves, rockers and tappets

With a valve clearance of 1,0 mm:	
– inlet valve opens	0°±2° B.T.D.C
– inlet valve closes	16°±2° A.B.D.C
– exhaust valve opens	39°±2° B.B.D.C
– exhaust valve closes	1°±2° A.T.D.C
Valve clearance cold and hot:	
– inlet valve	0,35 mm
– exhaust valve	0,35 mm
Angle of valve seat in cylinder head:	
– inlet valve	35° +20'
– exhaust valve	45° +20'
Width of valve seat in cylinder head:	
– inlet valve	2,9...3,7 mm
– exhaust valve	1,3...2,3 mm
Angle of valve face:	
– inlet valve	35° –20'
– exhaust valve	45° –20'
Outside diameter of valve head:	
– inlet valve	48 mm
– exhaust valve	41 mm
Max valve movement:	
– inlet valve	10,9 mm
– exhaust valve	12,1 mm
Inlet valve stem diameter	8,960...8,975 mm
Exhaust valve stem diameter	8,925...8,940 mm
Inlet valve stem clearance	0,025...0,055 mm
– Reject limit	0,30 mm
Exhaust valve stem clearance	0,060...0,090 mm
– Reject limit	0,35 mm
Inside diameter of valve guide before fitting	9,000...9,015 mm
Outside diameter of valve guide	16,028...16,039 mm
Diameter of valve guide bore in cylinder head	16,000...16,018 mm
Protrusion of valve guide top above cylinder head surface	21 mm
Depth of valve face below cylinder head surface:	
– inlet valve	0,7±0,05 mm
– exhaust valve	0,6±0,05 mm
Valve spring free length	69,8 mm
Spring pressure when spring compressed to a length of:	
– 48,6 mm	327±17 N
– 37,4 mm	500±23 N
Rocker arm shaft diameter	19,959...19,980
Inside diameter of rocker arm bearing bush:	
– (when fitted in position)	19,990...20,010 mm
Outside diameter of rocker arm bearing bush	23,035...23,075 mm
Diameter of rocker arm bore	23,000...23,021 mm
Max. permissible push rod deflection (when free)	0,4 mm
Free length of rocker arm spring	80 mm
Spring pressure when spring compressed to a length 58 mm	80...100 N
Outside diameter of tappet	29,939...29,960 mm
Diameter of tappet bore in cylinder block	30,000...30,043 mm
Engines from 96 week 34	
Rocker arm shaft diameter	22,970...22,990 mm
Diameter of rocker arm bore	23,000...23,021 mm

Camshaft

Diameter of camshaft bearing journal no 1	49,925...49,950 mm
Diameter of camshaft bearing journals (others that no 1)	49,885...49,910 mm
Diameter of camshaft bearing journals nos 2, 3 and 4 (620/634–engines)	49,865...49,890 mm
Inside diameter of camshaft bearing bushes (when fitted in position)	50,010...50,070 mm
Diameter of camshaft bearing bores (others than no 1)	50,000...50,025 mm
Camshaft clearance in bearing bush no 1	0,060...0,145 mm



20–10

Lubricating system (620/634–engines)

1. Lubricating oil pump
2. Pressure–relief valve
3. Oil filter
4. Turbocharger
5. Main oil gallery
6. Piston cooling nozzle
7. Oil pressure sensor

Lubricating system

The engine has a pressure lubricating system in which the oil pump (gear pump) is attached to the cylinder block lower face. The oil is sucked up by the pump through a suction strainer. After the pump the oil is led through an oilway to the relief valve and to the oil filter. After the filter, the oil is led through the main oil gallery from which oilways branch out. The oil is led through the oilways in the main bearings and through the crankshaft to the big–end bearings.

The oil is further directed from the main gallery to the injection pump, turbocharger, balancing unit (420) and to a possible compressor. In addition, the idler gear bushing, the camshaft bearing points and the valve mechanism get their lubrication oil via the main oil gallery.

In 620/634–engines, with high power rating, is the bottom of the piston cooled with oil spray always when the oil pressure is higher than 3 bar.

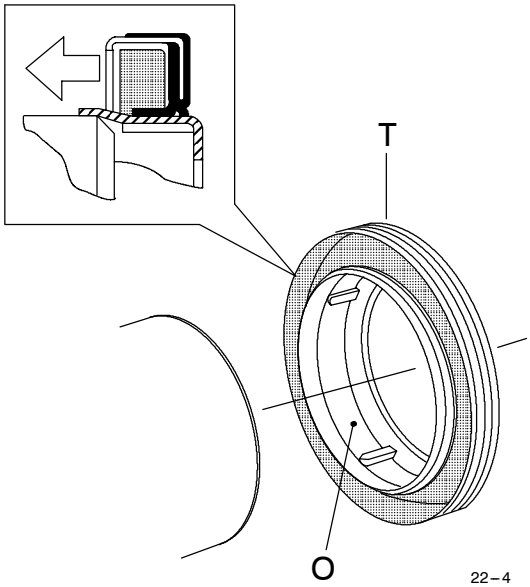
The oil pressure relief valve is located under the oil filter on the left hand side of the engine. The valve regulates the lubricating oil pressure so that it is kept constant, regardless of the engine speed. Oil pressure is about **2,5–4 bar** depending on revs, oil quality and temperature, and at engine idling speed the pressure is min **1,0 bar**.

The oil filter is full–flow disposable type and is fitted on the left–hand side of the engine. A by–pass valve is located at the base of the filter to ensure safe cold–starting or to ensure adequate lubrication in case the filter becomes blocked. In addition, there is a non–return valve which stops the filter from being emptied of oil.

5. Fit the seal as follows:

– Do not remove the plastic sleeve in before hand.

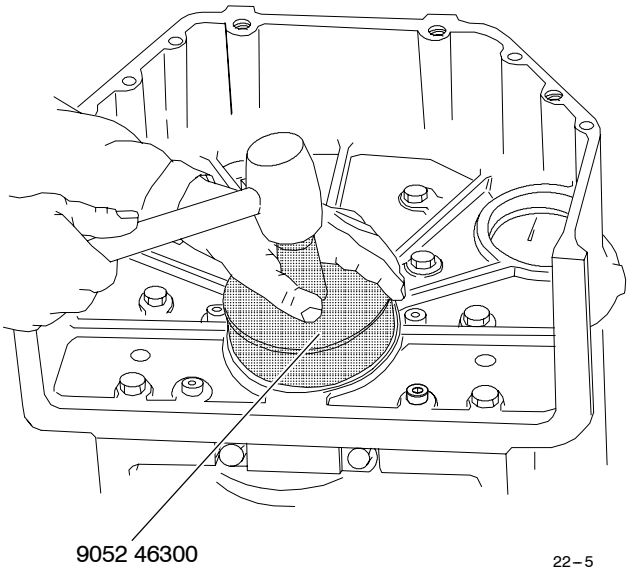
– **NOTE! FIT THE SEAL DRY, NOT OILED!**



O = Sleeve
T = Seal

– Put the sleeve against the crankshaft rear end so that the sleeve is on the shaft bevelling.

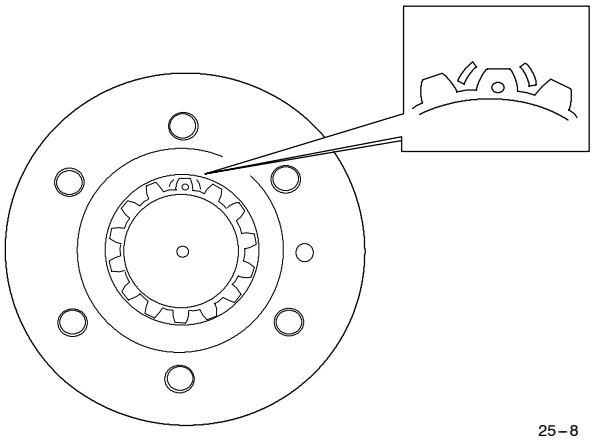
– Push the seal over the sleeve on the shaft and further against the flywheel housing.



– Remove the sleeve and hit the seal into position with the fitting tool 9052 46300.

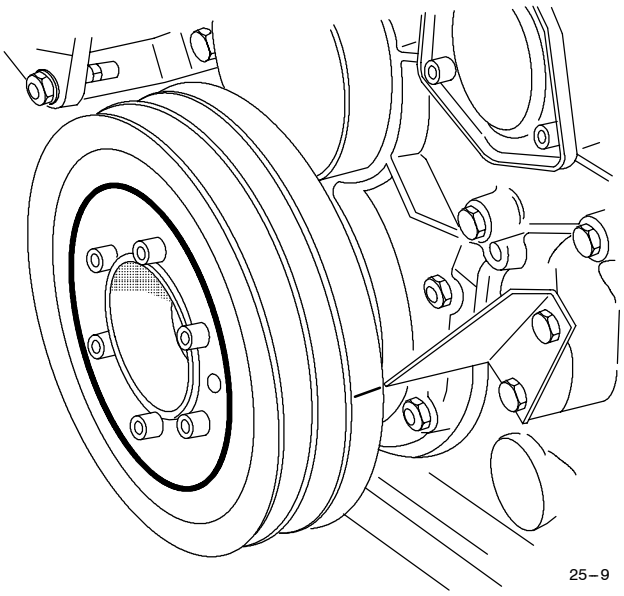
Note! 320–engines. Tightening torque of screws of crankshaft counterweight is **160 Nm**. Apply locking fluid Loctite 2701 on the screw threads.

F. Crankshaft hub piece



When fitting the hub piece to the crankshaft front end note the correct position of the hub. (Engines with the timing mark on the crankshaft pulley/vibration damper.) The hub piece has an installation mark – on two teeth and the corresponding installation mark • of the crankshaft is on one tooth.

G. Changing crankshaft pulley/vibration damper



1. Loosen the alternator fixing screws and remove the v–belt.

2. Open the bolts of the pulley/vibration damper and remove the parts. The pulley/vibration damper is positioned to the crankshaft hub with a timing indicator (engines with timing mark on the pulley/vibration damper).

3. Fix the new vibration damper/pulley on the crankshaft. Tap the timing indicator in its place and tighten the fixing screws to a torque of **30 Nm**.

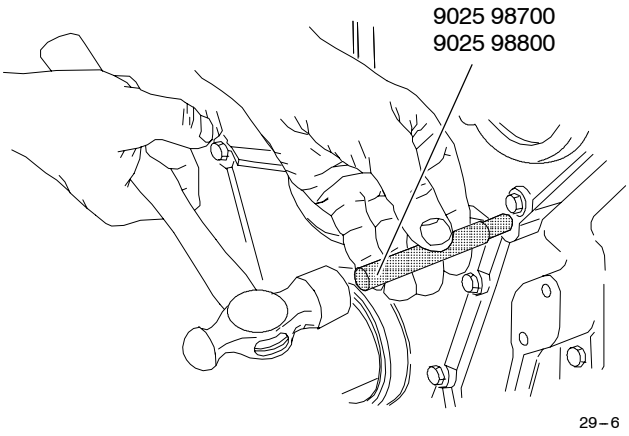
Note! Vibration dampers (pulleys) delivered as spare parts do not have injection timing mark. Make the marking on the new damper in connection with installation.

4. Rotate the crankshaft until the piston of the 1st cylinder reaches its top dead centre. Drop cyl. no 1 inlet valve down against the piston head. Set the dial gauge on top of the valve stem end and zero it at the piston top dead centre. Then rotate the crankshaft opposite to running direction until dial gauge shows about 15 mm below TDC. After that rotate the crankshaft slowly to running direction until the dial gauge shows the figure corresponding injection timing (see table below).

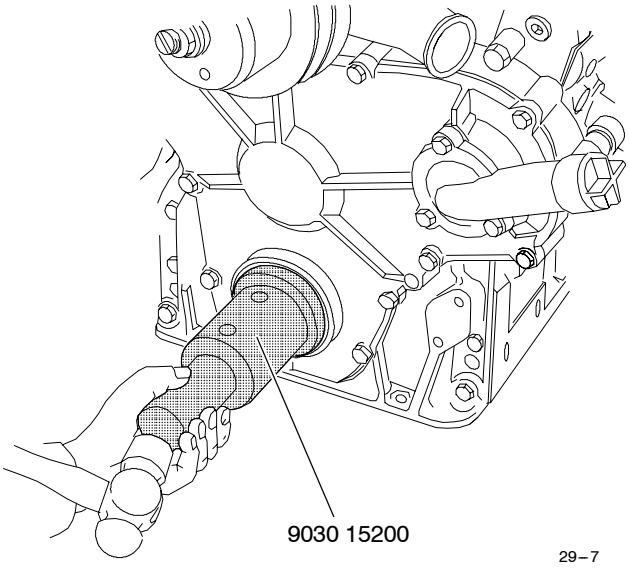
5. Mark the injection timing on the tip of indicator with an electric pen (**do not tap**).

Piston distance from top dead centre vs. crank angle

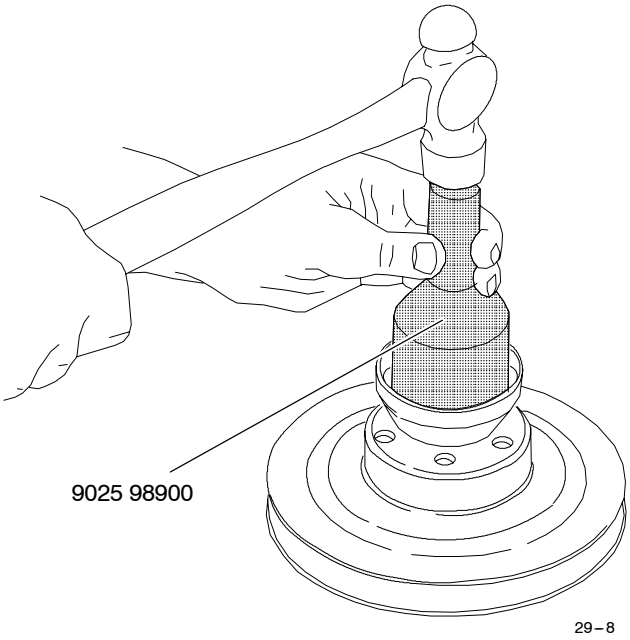
Grad	**320, 420, 620** mm	**634** mm
1°	0,012	0,013
2°	0,047	0,054
3°	0,106	0,121
4°	0,188	0,216
5°	0,294	0,337
6°	0,423	0,485
7°	0,576	0,660
8°	0,752	0,861
9°	0,951	1,089
10°	1,173	1,344
11°	1,418	1,624
12°	1,686	1,931
13°	1,976	2,264
14°	2,289	2,623
15°	2,625	3,007
16°	2,983	3,417
17°	3,363	3,852
18°	3,765	4,312
19°	4,188	4,797
20°	4,633	5,307
21°	5,100	5,841
22°	5,587	6,399
23°	6,095	6,980
24°	6,624	7,585
25°	7,173	8,214
26°	7,742	8,865
27°	8,331	9,539
28°	8,939	10,235
29°	9,567	10,952
30°	10,213	11,692



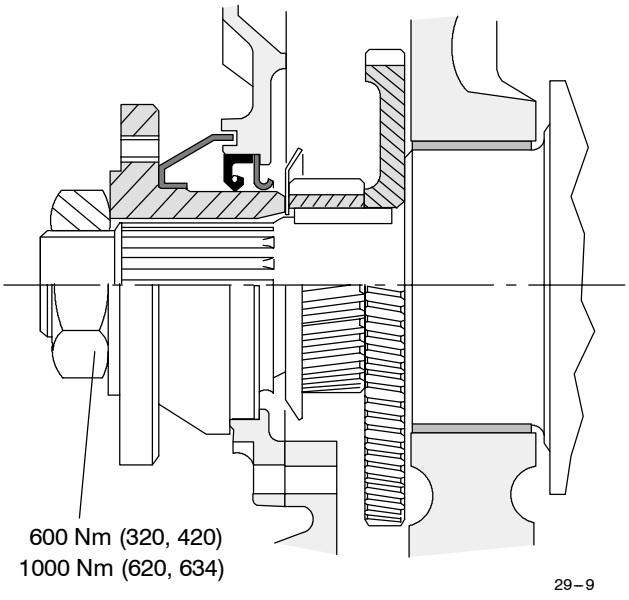
6. Fit the oil deflector ring on the crankshaft and fit the timing gear casing cover using a new gasket. Drive in the tension pins with drifts 9025 98700 and 9025 98800 respectively (the tubular pin round the screw stud). Tighten bolts and nuts.



7. Fit the protective plate into the seal location and fit the crankshaft front seal with special tool 9030 15200.



8. Fit the dust shield on the crankshaft V–belt pulley hub, if it has been removed. Use drift 9025 98900.



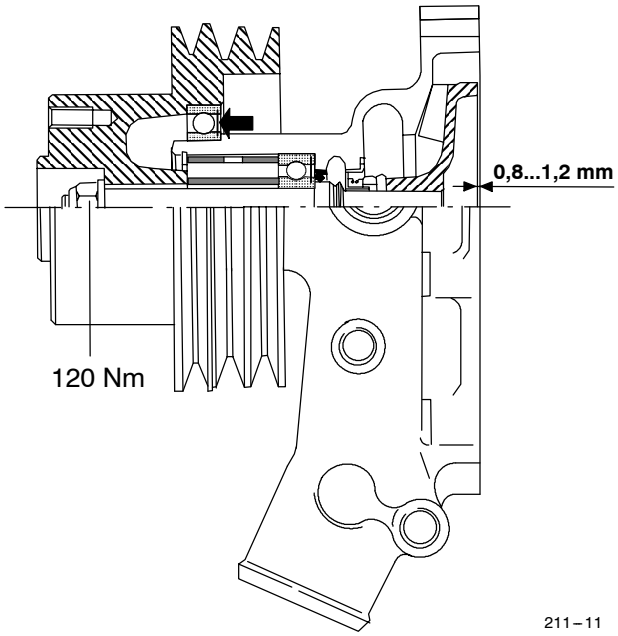
9. Lubricate both the seal and sealing surfaces and fit the crankshaft V–belt pulley with hub.

10. Lubricate the crankshaft nut threads. Tighten the nut to **600 Nm** on 320– and 420–engines and **1000 Nm** on 620 and 634 engines.

11. Fit the other detached parts.

D. Coolant pumps with heavy–duty bearings (620, 634)

Some versions of 620/634–engines have a heavy–duty bearings in the coolant pump. The reconditioning of this pump is done according to the instruction in part **C**. Note specially the position of the front bearing as assembling.



E. Quality requirements of coolant

The coolant used must meet the standards ASTM D 3306 or BS 6580:1992.

– Mixing proportion should be 40–60 % of ethylene/propylene–glycol based coolant and the rest water. The best ratio is 50/50 %.

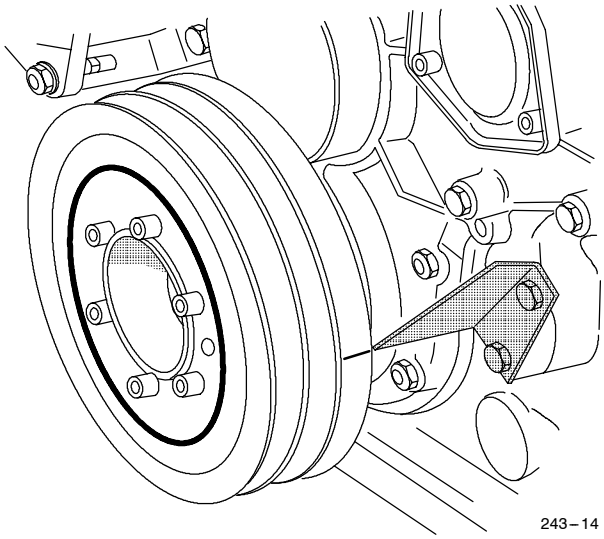
– In warm climates the 30 % mixture ratio gives enough good protection against corrosion.

– Water used should be clean and soft water i.e. that it does not include metals and their salts.

– Check the coolant frost resistance every now and then. Change the coolant every other year.

Note! Never use only water as coolant!

F. Checking injection timing



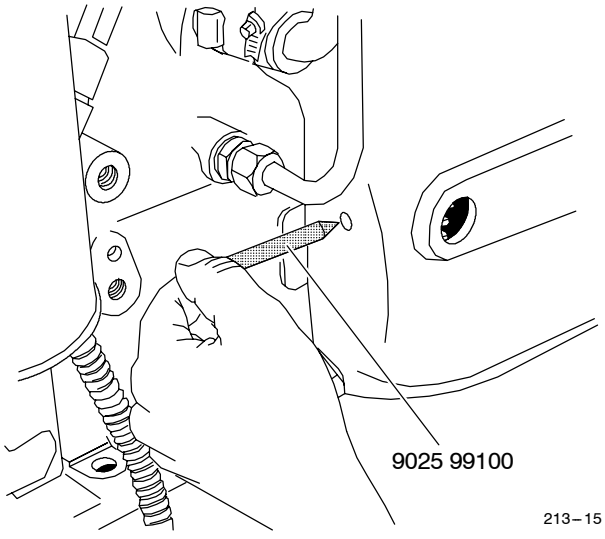
The injection timing for cylinder no. 1 is marked on the crankshaft pulley. The timing indicator can be on the right or left side of the pulley, depending on engine version. In some tractor versions the timing mark is on the flywheel.

Note! Due to the automatic excess fuel feed of the injection pump the control rod must be moved to drive position before checking the injection timing, otherwise the injection timing will be 8° incorrect!

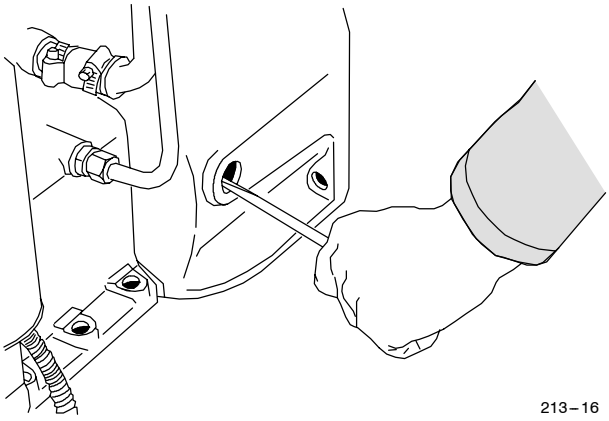
1st way of checking

1. Clean the injection pump and its surroundings carefully.

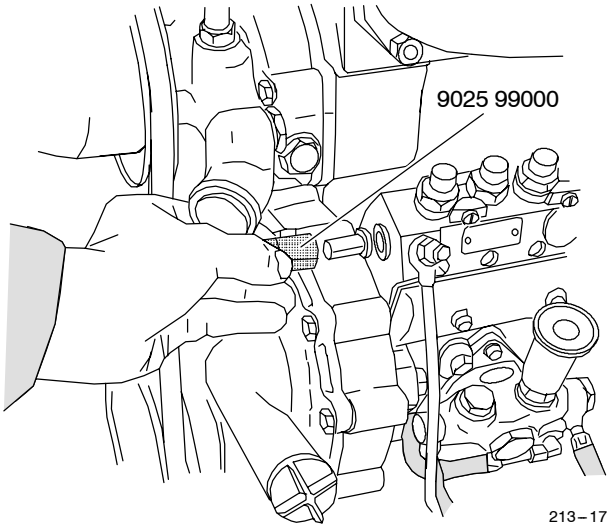
2. In tractor engines remove the inspection hole rubber plug from the flywheel housing.



3. Insert the locator (9025 99100) in the hole on the flywheel housing front face.



4. Turn the crankshaft to a position where the 1st cylinder piston reaches its compression stroke top dead centre. Then turn the crankshaft backwards until the timing mark on the pulley (flywheel) passes the timing indicator.



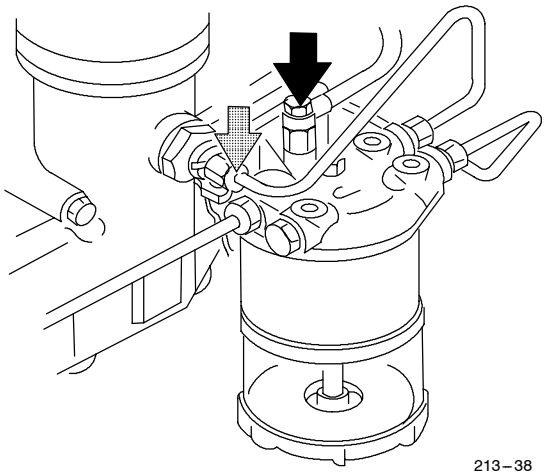
5. Remove the protecting cap for the control rod on the injection pump front face. Fit adjusting tool (sleeve for limiting control rod travel) 9025 99000. The tool moves the control rod to the ”running position”.

6. Disconnect the delivery pipe for the number one cylinder injector at the pump.

7. Clean the delivery valve of fuel. Slowly turn the crankshaft in the correct direction of rotation until the fuel level in the delivery valve just begins to rise.

8. Check if the mark on the pulley is at the point of the timing indicator the injection timing is correct. Repeat the check procedure. If the injection pump needs to be adjusted, follow the instructions under heading **13 G**.

9. Fit the delivery pipe and the rubber plug in the flywheel housing. Remove the locator and the sleeve which was used to limit the control rod travel. Start the engine.



213–38

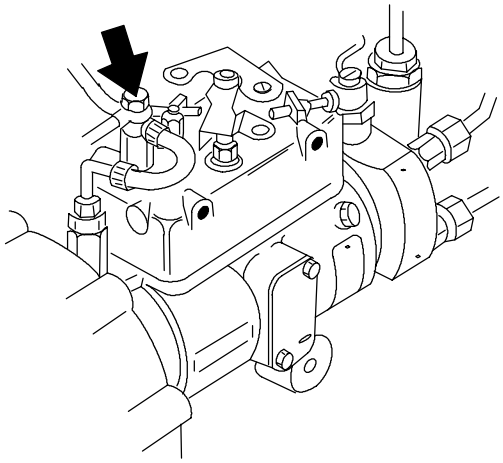
2. Unscrew the bleed screw on the top of the fuel filter

3. Pump with the hand pump until the fuel running out of the bleed screw is free of air bubbles.

4 Close the bleed screw. Clean the engine of leaked fuel.

Bleed the injection pump

1. Turn the ignition key to the position ON (stop solenoid is opening)



213–37

2. Unscrew the bleed screw on the top of the injection pump.

3. Pump with the hand pump until the fuel running out of the bleed screw is free of air bubbles.

4. Close the bleed screw. Switch off the current. Clean the engine of leaked fuel.

Bleed the thermostart system

Always remove air from the glow plug fuel pipe when the pipe or reservoir has been emptied during repair work etc. This prevents damages to the glow plug caused by lack of fuel during starting.

1. Open the pipe adaptor of the glow plug.

2. Pump with the hand pump until the fuel is running out of the pipe adaptor.

3. Tighten the pipe adaptor. Clean the engine of leaked fuel.

D. Feed pump

The feed pump of diaphragm type is not supplied with spare parts separately, replace the complete pump if the feed pressure is very low (min. **0,20 bar**/max. rpm) or the pump has otherwise been damaged.

E. Injector

The inspection and reconditioning of the injector is mainly done in the instruction **13 L...O** on pages **13–13...13–15**. The difference is opening pressure and the adjusting shims.

The new injector has a opening pressure of **250^{+8} bar**. An used injector has a opening pressure of **230^{+8} bar**.

The adjusting shims are delivered with a 0,02 mm difference, from 0,42 to 0,70 mm thickness. Also 0,30, 1,00, 1,28 and 1,56 mm thick shims are available. A difference of 0,02 mm in the shim thickness changes the opening pressure about 2 bar.

Note! Ensure that always the correct nozzle type is used, because an incorrect nozzle leads to incorrect function of the engine and damages.

Trouble shooting

If the timing deviates remarkably from given, check the following:

1. Vibrating delivery pipe, hold the pipe with hand.

2. Distance of magnetic probe from flywheel not correct, re–set the magnetic probe.

3. ”Offset” or “Trig Level” value wrong, re–set.

4. Disturbing scratches on the flywheel.

5. Alignment of flywheel–crankshaft wrong, remove the flywheel and reassemble correct.

FUEL SYSTEM
EQUIPMENT AND FEEDING TABLE

634

Test equipment ISO 4008
Fluid ISO 4113
Pipes ø 6 x 2 x 600 ISO 4093

Nozzle ISO 4010 173 bar or
nozzle ISO 7440 207 bar
0,60 orifise plate

Engine	Application	Pump spare part no Fuel adjustment card	Pump Governor	Injection advance° Max. output r/min Idling r/min Output kW		Feed rate mm³/stroke rpm	ISO 7440 mm³	RW mm	Control rod min. –1 mm rpm	Control rod position 4 mm rpm	Element Pressure valve Covernor spring
634 D	Valmet 8200	8368 54570 18.201	PES 6A 95D 320 RS 2806 /EG RSV 500–1125 A0C 2178–8R	22 2225 750 96		1100 1000 900 800 750 600 375	86–88 11–13	9,8...10,2 9,9...10,3 10,1...10,5 10,2...10,6 10,3...10,7 10,3...10,7 3,8...4,2	1130	1190–1210	8353 31161 8353 39126 8353 31780
634 DS	Steyr 9190A MF 3690	8368 54524 18.223	PES 6A 95D 320 RS 2848 RSV 500–1100 A5C 2269–R	20 2200 1000 140	1,0(* 1,0 1,0 1,0 1,0 0,65 0,42 0,0	1100 1000 900 800 750 600 LDA 500 500 500 500	120–122 16–19	13,8...14,2 13,9...14,3 14,1...14,5 14,2...14,6 14,3...14,7 14,3...14,7 14,0...14,4 12,4...12,8 12,2...12,6 6,5...7,5	1115	1180–1200	8353 31161 8353 39126 8353 54532

*) boost pressure regulators pressure bar