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1. ENGINE GENERAL

1.1 GENERAL

The terms **COLD ENGINE** and **WARM ENGINE** are defined as follows:

COLD ENGINE
A **cold engine** is an engine which, having reached operating temperature, has been allowed to cool down for at least **six hours**.

WARM ENGINE
A warm engine is an engine which, having reached operating temperature, has not been at a standstill for more than **thirty minutes**.

Direction of rotation of the engine
The direction of rotation of the engine is clockwise, as seen from the timing gear end.

First cylinder of the engine
The first cylinder of the engine is the cylinder at the timing gear end.

Left-hand and right-hand side of the engine
The left-hand side of the engine is the side where the fuel pump is mounted.

The right-hand side of the engine is the side where the air compressor is mounted.

1.2 XF ENGINE GENERAL

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Engine types

Coding	XF 280 M XF 315 M XF 355 M

General specifications

Environmental standard	Euro 2 (M)
Number of cylinders	6
Valves	4 valves per cylinder
Bore x stroke	130 x 158
Cubic capacity	12.58 litres
Compression ratio	16.0 : 1
Fuel injection	direct injection
Injection sequence	1-5-3-6-2-4
Air inlet system	Turbocharger intercooling
Fuel system	in-line pump
Cooling	fluid
Weight	approx. 1049 kg

XF-engine speeds

ENGINE TYPE	IDLING SPEED rpm	MAX. NO LOAD SPEED rpm
XF 280 M	525 - 575	approx. 2300
XF 315 M	525 - 575	approx. 2300
XF 355 M	525 - 575	approx. 2300

1.3 XE ENGINE GENERAL

Engine types

Coding	XE 280 C XE 315 C XE 355 C XE 390 C

General specifications

Environmental standard	Euro 3 (C)
Number of cylinders	6
Valves	4 valves per cylinder
Bore x stroke	130 x 158
Cubic capacity	12.58 litres
Compression ratio	16.0 : 1
Fuel injection	direct injection
Injection sequence	1-5-3-6-2-4
Air inlet system	Turbocharger intercooling
Engine management system	UPEC
Cooling	fluid
Weight	approx. 1080 kg

XE-engine speeds

ENGINE TYPE	IDLING SPEED rpm	MAXIMUM NO LOAD SPEED rpm
XE 280 C	525 - 575	approx. 2270
XE 315 C	525 - 575	approx. 2270
XE 355 C	525 - 575	approx. 2270
XE 390 C	525 - 575	approx. 2270

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2. XF-ENGINE FUEL SYSTEM

2.1 GENERAL

Injection timing

XF 280 M	12.5° before TDC
XF 315 M	12.5° before TDC
XF 355 M	13.5° before TDC

Gallery pressure

At full-load engine speed	0.5 bar minimum

Fuel level element

Angular displacement	86°
Underpressure valve opening pressure	10 - 20 mbar
Overpressure valve opening pressure	200 - 300 mbar

Overview, injector

Engine type	Number of holes in nozzle	Nozzle no.	Hole diameter	Bar filter	Pressure setting	Control pressure
XF 280 M	8	657	0.238	Yes	230 - 240 bar	200 - 240 bar
XF 315 M	8	657	0.238	Yes	230 - 240 bar	200 - 240 bar
XF 355 M	8	579	0.25	Yes	230 - 240 bar	200 - 240 bar

Overview, fuel pumps

Engine type	Fuel pump type	Injection timing device	Delivery valve	Refacing edge	Helix top
XF 280 M	P 7100	RQV-K	CPV	no	no
XF 315 M	P 7100	RQV-K	CPV	no	no
XF 355 M	P 8500	RQV-K	CPV	no	no

2.2 TIGHTENING TORQUES

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Fuel pump	
Fuel pump coupling nut (pump side)	
P 7000 (M20 x 1.5)	195 Nm
P 8500 (M24 x 1.5)	215 Nm
Bolts for attaching fuel pump to support	60 Nm
Clutch plates / fuel pump drive attachment bolts	
Attachment bolts Bolts should not be re-used; **always** use new bolts.	110 Nm + 60° angular displacement
Drive clamping piece clamping bolt Never re-use bolt: **always** use new bolt.	100 Nm + 60° angular displacement
Injectors	
Injector union nut	45 Nm
Clamping piece attachment bolt Bolt should not be re-used; **always** use new bolt.	30 Nm + 60° angular displacement
Injector pipes	
Injector pipes union nut	25 Nm

3. XF-ENGINE INTAKE/EXHAUST SYSTEM

3.1 GENERAL

Explanation, GARRETT turbocharger type designation

Example of type designation:
GT42-94S/54NPS/1.44-84

GT42	Turbine type designation
94	Maximum compressor wheel diameter
S	Wastegate model
54	Compressor wheel trim
NPS	Version with intake side without compressor housing by-pass
PS	Version with intake side with compressor housing by-pass
1.44	Dimensions, turbine housing
84	Turbine wheel trim

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Explanation, K.K.K. turbocharger type designation

Example of type designation:
K31-3971QYBKB22.91DCAYD

K31	Turbine build series
39	Diameter of compressor wheel 3.9 inch
71	Diameter ratio of compressor wheel d/d
Q	Compressor wheel development letter
Y	Compressor housing development letter
B	Compressor housing variant
K	K = compressor housing with recirculation (= ported shroud) A = compressor housing with no recirculation (= non-ported shroud)
B	B = recirculation variant A = no recirculation
22	surface of turbine housing throat (cm^2)
9	Turbine housing version number 9 = with wastegate 2 = without wastegate
1	Turbine trim figure: 2 = d/d = 89.5 (trim 80) 0 = d/d = 87 (trim 76) 1 = d/d = 84 (trim 70) 3 = d/d = 79 (trim 62)
D	Turbine wheel development letter
C	Turbine housing development number
A	Turbine housing variant
Y	Turbine inlet flange dimension Y = dimension for a 12.6 litre engine W = dimension for a 9.2 litre engine T = dimension for a 6.2 litre engine
D	Turbine housing material: B = GG 40 D = Simo F = Nirisist d2 H = Nirisist d3 K = Nirisist d5

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Turbocharger	
Stud bolt attachments	Copaslip (DAF No. 1284344)
GARRETT wastegate	
Movement of control rod at 1.85 ± 0.05 bar	1 mm
K.K.K. wastegate	
Movement of control rod at 2.10 bar	3.5 mm ± 0.6
Exhaust back pressure	
At full-load engine speed	90 mbar
Inlet underpressure	
At full-load engine speed	25 - 45 mbar

3.2 TIGHTENING TORQUES

Turbocharger	
Connection to exhaust manifold	60 Nm(2)
Bend on turbocharger	40 Nm
Heat shield attachment bolts	15 Nm(1)
Turbine housing clamping plate attachment nut	15 Nm
Air inlet	
Air inlet hose clamps	12 Nm

(1) Apply Loctite 243 to secure
(2) Apply Copaslip to secure

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4. XF-ENGINE BRAKE

4.1 GENERAL

DEB

Magneetventiel'''	
Resistance value	
Cold (20°C)	32.6 - 36.8 Ω
Hot (80°C - 100°C)	41.8 - 46.1 Ω
Oil pressure	
Minimum cut-in pressure	1.5 bar
Maximum service pressure	4.5 bar
Maximum pressure, DEB control valve	8.0 bar
Settings	
DEB setting	1.40 mm
Exhaust brake	
Butterfly valve calibration opening	
With DEB	12 mm
Without DEB	8 mm

4.2 TIGHTENING TORQUES

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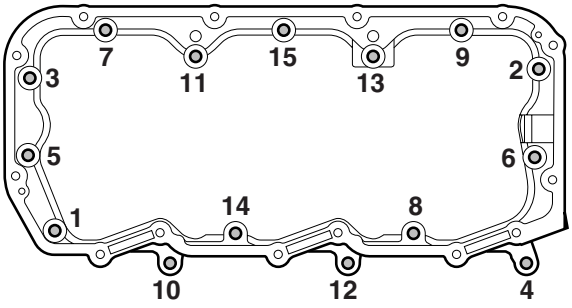
DEB

Valve cover attachment bolts	25 Nm
Rocker setting bolt lock nut	40 Nm
Bridge piece setting bolt lock nut	40 Nm
Rocker-bracket attachment bolts	110 Nm
Valve sleeve attachment bolts	30 Nm

Tighten the valve sleeve bolts in the sequence shown.



M200942

DEB set screw nut	25 Nm
Solenoid valve	20 Nm
Wiring harness attachment bolt	9 Nm
Spring plate fixing bolt	12.5 Nm

5. XE-ENGINE FUEL SYSTEM

5.1 GENERAL

Gallery pressure

At starting speed	approx. 2 bar
At idling speed	approx. 3 bar
At maximum no-load engine speed	approx. 4 bar

Fuel level element

Angular displacement	86°
Underpressure valve opening pressure	10 - 20 mbar
Overpressure valve opening pressure	200 - 300 mbar

Overview, injector

Engine type	Number of holes in nozzle	Nozzle no.	Hole diameter	Bar filter	Pressure setting	Control pressure
XE 280 C	8	810	0.195	Yes	300 - 310 bar	270 - 310 bar
XE 315 C	8	810	0.195	Yes	300 - 310 bar	270 - 310 bar
XE 355 C	8	810	0.195	Yes	300 - 310 bar	270 - 310 bar
XE 390 C	8	810	0.195	Yes	300 - 310 bar	270 - 310 bar

Fuel lift pump

Fuel lift pump pressure	3 - 8 bar
Pressure-relief valve opening pressure	approx. 8.5 bar

Pump housing

Weight, including camshaft and pump units	approx. 70 kg
Pressure-relief valve opening pressure	approx. 2.8 bar

5.2 TIGHTENING TORQUES

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Injector pipes	
Injector pipes union nut	25 Nm
Injectors	
Injector union nut	45 Nm
Clamping piece attachment bolt	30 Nm + 60° angular displacement
Always replace attachment bolt	
Leak-off pipe banjo bolt	20 Nm
Pump housing	
Pressure-relief valve	20 Nm
Attachment bolts to connect pump housing to engine block	60 Nm
Pump housing rear cover attachment bolts	30 Nm
Pump camshaft locking plate attachment bolts	30 Nm
Attachment bolts for pump housing sealing plates	30 Nm
Attachment bolts for pulse wheel on camshaft	30 Nm(1)
Non-return valve	45 Nm
Pump unit	
Bolts for attaching pump units to pump housing	46 Nm
Fuel lift pump	
Attachment bolts to connect fuel lift pump to pump housing	30 Nm(1)

(1) Use Loctite 243 to secure

6. XE-ENGINE INTAKE/EXHAUST SYSTEM

6.1 GENERAL

Explanation of turbocharger type designation
Example of type designation:
GT41-94S/54NPS/1.44-84

GT42	Turbine type designation
94	Maximum compressor wheel diameter
S	Wastegate model
54	Compressor wheel trim
NPS	Version with intake side without compressor housing by-pass
PS	Version with intake side with compressor housing by-pass
1.44	Dimensions, turbine housing
84	Turbine wheel trim

Turbocharger

Stud bolt attachments	Copaslip (DAF No. 1284344)

Electronically controlled wastegate

Engine type	Turbocharger		Adjustment pressure for 1 mm movement of control rod
	DAF No.	GARRETT No.	
XE355C	1344152	452281-4	1.55 ± 0.05 bar
	1377426	452281-8	1.65 ± 0.05 bar
XE390C	1356820	452281-5	1.65 ± 0.05 bar
	1377426	452281-8	1.55 ± 0.05 bar
	1397101	452281-9	1.65 ± 0.05 bar

Mechanical wastegate

Engine type	Turbocharger		Adjustment pressure for 1 mm movement of control rod
	DAF No.	GARRETT No.	
XE315C	1453883	452281-10	2.10 ± 0.05 bar
XE355C	1344152	452281-4	2.00 ± 0.05 bar
	1377426	452281-8	2.00 ± 0.05 bar
	1453883	452281-10	2.10 ± 0.05 bar
XE390C	1356820	452281-5	2.00 ± 0.05 bar
	1377426	452281-8	2.00 ± 0.05 bar
	1397101	452281-9	2.00 ± 0.05 bar
	1453883	452281-10	2.10 ± 0.05 bar

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Pressure-reducer valve	
Governed pressure	1.75 - 2.05 bar
Exhaust back pressure	
At full-load engine speed	80 - 90 mbar
Inlaatonderdruk“	
At full-load engine speed (clean air filter)	25 - 45 mbar
At full-load engine speed (clogged air filter)	54 - 64 mbar

6.2 TIGHTENING TORQUES

Turbocharger	
Connection to exhaust manifold	60 Nm(2)
Bend on turbocharger	40 Nm
Heat shield attachment bolts	15 Nm(1)
Turbine housing clamping plate attachment nut	15 Nm
Air inlet	
Air inlet hose clamps	12 Nm

(1) Secure with Loctite
(2) Apply Copaslip to secure

7. XE-ENGINE BRAKE

7.1 GENERAL

DEB

Solenoid valve

Resistance value	
Cold (20°C)	32.6 - 36.8 Ω
Hot (80°C - 100°C)	41.8 - 46.1 Ω

Oil pressure

Minimum cut-in pressure	1.5 bar
Maximum service pressure	4.5 bar
Maximum pressure, DEB control valve	8.0 bar

Settings

DEB setting	1.40 mm

Exhaust brake

Calibration opening, butterfly valve with DEB	12 mm
Calibration opening, butterfly valve without DEB	8 mm

7.2 TIGHTENING TORQUES

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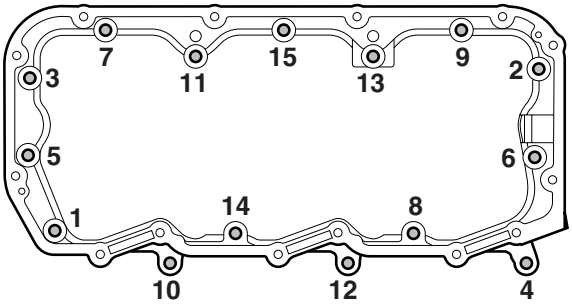
DEB

Valve cover attachment bolts	25 Nm
Rocker setting bolt lock nut	40 Nm
Bridge piece setting bolt lock nut	40 Nm
Rocker-bracket attachment bolts	110 Nm
Valve sleeve attachment bolts	30 Nm
Tighten the attachment bolts in the order indicated	



M200942

DEB set screw nut	25 Nm
Solenoid valve	20 Nm
Wiring harness attachment bolt	9 Nm
Spring plate fixing bolt	12.5 Nm

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1. TRACTIVE PROBLEMS

Before a boost pressure curve is plotted, an acceleration test must be performed.
For the acceleration test see Group 2 of the workshop instructions, main group 1 “Diagnosis”.

Note:
Checking the boost pressure will in general only make sense after the vehicle has covered at least 20,000 km.

The test sheets are available through the DAF organisation.
If no test sheet is available for the engine type in question, you may compare the engine with a different engine having the same specifications, as long as the latter is in good condition.

To plot a boost pressure curve, see main group “Inlet/exhaust system”.

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2. XF ENGINE FUEL SYSTEM

2.1 FAULT-FINDING TABLE

FAULT: ENGINE KNOCKS	
Possible cause	**Remedy**
Incorrect or contaminated injectors installed.	Check whether correct injectors have been installed. Clean contaminated injectors and set them.
Incorrect injection timing, or incorrect fuel pump setting.	Check the injection timing and/or fuel pump setting.

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3. XF ENGINE INLET AND EXHAUST SYSTEM

3.1 FAULT-FINDING TABLE

FAULT: ENGINE TEMPERATURE INCREASES	
Possible cause	**Remedy**
Contaminated intercooler.	Check/clean intercooler.
Wastegate setting is too high.	Check wastegate setting.
Air hose from the turbocharger compression chamber to the wastegate diaphragm leaks or is not connected.	Check air hose. Replace if necessary.

FAULT: ENGINE USES TOO MUCH OIL	
Possible cause	**Remedy**
Air cleaner element blocked.	Clean or replace air cleaner element.
Blocked air inlet to turbocharger.	Check air inlet and remove any obstacles.
Compressor side of turbocharger contaminated.	Clean compressor side with a non-corrosive cleaning agent or a soft brush. Check the inlet side for carbon deposits or other contamination.
Turbocharger oil discharge pipe is blocked.	Check turbocharger oil discharge pipe. Replace the pipe, if necessary.
Damaged turbocharger.	Replace turbocharger and identify the cause.

FAULT: ENGINE PRODUCES EXTREME SMOKE LEVELS	
Possible cause	**Remedy**
Air cleaner element blocked.	Clean or replace air cleaner element.

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FAULT: RISING AND FALLING TURBOCHARGER SOUNDS	
Possible cause	**Remedy**
Blocked air inlet to turbocharger.	Check air inlet and remove any obstacles.
Compressor side of turbocharger contaminated.	Clean compressor side with a non-corrosive cleaning agent or a soft brush. Check the inlet side for carbon deposits or other contamination.
Damaged turbocharger.	Replace turbocharger and identify the cause.

FAULT: BLACK SMOKE EMERGING FROM EXHAUST	
Possible cause	**Remedy**
Air cleaner element blocked.	Clean or replace air cleaner element.
Air leak between turbocharger and inlet manifold.	Check pipes and pressurise inlet unit.
Air leak between inlet manifold and cylinder head.	Check for leaks. Replace gaskets, if necessary.
Compressor side of turbocharger contaminated.	Clean compressor side with a non-corrosive cleaning agent or a soft brush. Check the inlet side for carbon deposits or other contamination.
Gas leak between exhaust manifold and cylinder head.	Check attachment bolts and gaskets.
Gas leak between exhaust manifold and turbocharger.	Check attachment bolts and gaskets.
Damaged turbocharger.	Replace turbocharger and identify the cause.

FAULT: BLUE SMOKE EMERGING FROM EXHAUST	
Possible cause	**Remedy**
Air cleaner element blocked.	Clean or replace air cleaner element.
Air leak between turbocharger and inlet manifold.	Check pipes and pressurise inlet unit.
Air leak between inlet manifold and cylinder head.	Check for leaks. Replace gaskets, if necessary.
Compressor side of turbocharger contaminated.	Clean compressor side with a non-corrosive cleaning agent or a soft brush. Check the inlet side for carbon deposits or other contamination.
Turbocharger oil discharge pipe is blocked.	Check oil pipe. Replace if necessary.
Damaged turbocharger.	Replace turbocharger and identify the cause.

FAULT: OIL LEAK AT TURBINE SIDE OF TURBOCHARGER	
Possible cause	**Remedy**
Compressor side of turbocharger contaminated.	Clean compressor side with a non-corrosive cleaning agent or a soft brush. Check the inlet side for carbon deposits or other contamination.
Turbocharger oil discharge pipe is blocked.	Check oil pipe. Replace if necessary.
Damaged turbocharger.	Replace turbocharger and identify the cause.

FAULT: OIL LEAK AT COMPRESSOR SIDE OF TURBOCHARGER	
Possible cause	**Remedy**
Air cleaner element blocked.	Clean or replace air cleaner element.
Olieleiding turbo verstopt.	Check oil pipe. Replace if necessary.
Damaged turbocharger.	Replace turbocharger and identify the cause.

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FAULT: EXHAUST BACK PRESSURE TOO HIGH	
Possible cause	**Remedy**
Incorrect butterfly valve setting.	Check the setting of the butterfly valve.
Butterfly valve incorrectly positioned.	Check whether the butterfly valve has been positioned correctly.
Butterfly valve partially operated by residual pressure in the operating cylinder.	Check operating cylinder.
No original exhaust silencer fitted.	Check exhaust silencer.
Exhaust pipe crushed or internally blocked by a loose part.	Check exhaust system for blockage and/or damage.

FAULT: INLET UNDERPRESSURE TOO HIGH	
Possible cause	**Remedy**
Blocked air cleaner.	Check air cleaner element.
Obstruction in intake ducts at the rear of the cab.	Check the intake ducts.

4. XF ENGINE BRAKE

4.1 FAULT-FINDING TABLE

FAULT: EXHAUST BRAKE DOES NOT ENGAGE	
Possible cause	**Remedy**
Compressor delivers insufficient air pressure.	Check the operation of the compressor.
Defective engine stop valve.	Check engine stop valve.
Air leak in the air pipe from air drier to engine stop valve.	Check air pipe.
Butterfly valve stuck in butterfly valve housing.	Check free movement of butterfly valve.
Defective engine stop operating cylinder.	Check operating cylinder.
Electrical fault.	Check electrical circuit.

FAULT: EXHAUST BRAKE REMAINS ENGAGED	
Possible cause	**Remedy**
Defective engine stop valve.	Check engine stop valve.
Defective engine stop operating cylinder.	Check operating cylinder.
Butterfly valve stuck in butterfly valve housing.	Check free movement of butterfly valve.
Electrical fault.	Check electrical circuit.

FAULT: DEB CANNOT BE SWITCHED ON	
Possible cause	**Remedy**
Electrical fault.	Check electrical circuit.
Engine oil pressure too low.	Check engine oil pressure.

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FAULT: DEB REMAINS ENGAGED	
Possible cause	**Remedy**
Elektrische storing.	Check electrical circuit.
Magnetic valve mechanically blocked.	Check magnetic valve.
Damaged magnetic valve sealing rings.	Replace all magnetic valve sealing rings.

FAULT: DEB OPERATES IRREGULARLY	
Possible cause	**Remedy**
Electrical fault.	Check electrical circuit.
Incorrect setting of DEB clearance.	Check DEB setting.
Main piston stuck in DEB housing.	Check free movement of main piston.
Operating piston stuck in DEB housing.	Check free movement of operating piston.
Damaged magnetic valve sealing rings.	Replace all magnetic valve sealing rings.
Magnetic valve oil strainer is blocked.	Clean magnetic valve oil strainer.
Control valve stuck in DEB housing.	Check free movement of control valve.
Defective control valve.	Check the operation of the control valve.
Lubricating oil too thick.	Run the engine at operating temperature.
Lubricating oil diluted with fuel.	Check lubricating oil for dilution.
Air bubbles in the oil.	Check the engine’s oil level/oil specification.
Oil duct plugs in DEB housing.	Clean/replace plugs.

5. XE ENGINE FUEL SYSTEM

5.1 FAULT-FINDING TABLE

FAULT: ENGINE CAN BE STARTED, BUT DOES NOT RUN	
Possible cause	**Remedy**
Poor fuel quality.	Poor fuel quality.
Air in the fuel system.	Check the fuel system for drawing in air: - through suction pipe - through sealing ring of fuel lift pump.
Fuel fine filter/fuel coarse filter blocked.	Replace the fuel fine filter and clean the system.
Incorrect pump housing camshaft timing, camshaft position sensor signal not present at correct moment.	Check timing/signal from camshaft position sensor.
No fuel supply/fuel lift pump defective, no output.	Check: - fuel level - pipes for clogging and leakage - fuel lift pump - gallery pressure.
Pressure-relief valve on pump housing does not shut off.	Check gallery pressure.
Fault in electrical components/wiring of: - connectors - pump unit - electronic unit - crankshaft position sensor and camshaft position sensor.	Check the electrical system.

FAULT: ENGINE STALLS AND PICKS UP AFTER RESTARTING	
Possible cause	**Remedy**
Air in the fuel system.	Check the fuel system for drawing in air: - through suction pipe - through sealing ring of fuel lift pump.
Pressure-relief valve on pump housing does not shut off.	Check gallery pressure.

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FAULT: ENGINE DOES NOT PICK UP PROPERLY	
Possible cause	**Remedy**
Poor fuel quality.	Drain fuel, rinse the fuel system, replace the fuel filters and fill the fuel tank with fuel.
Air in the fuel system.	Check the fuel system for drawing in air: - through suction pipe - through sealing ring of fuel lift pump.
Fuel fine filter/fuel coarse filter blocked.	Replace the fuel fine filter and clean the system.
Connection points on pump units changed.	Install the correct connection points on the correct pump unit.
Mechanical defect or clogging of pump units.	Replace the pump units.
Injectors defective.	Check the injectors.
Pressure-relief valve on pump housing does not shut off.	Check gallery pressure.
Fuel lift pump output too low.	Check: - the fuel lift pump and replace, if necessary - gallery pressure.
Fault in electrical components/wiring of: - connectors - crankshaft position sensor - sensor for engine coolant temperature - pump unit - camshaft position sensor.	Check the electrical system.

FAULT: ENGINE RUNS AT (INCREASED) IDLING SPEED AND DOES NOT RESPOND TO ACCELERATOR PEDAL	
Possible cause	**Remedy**
Accelerator pedal sensor, mechanical defect.	Check: - mechanical connection sensor/accelerator pedal - accelerator pedal sensor.

FAULT: DIESEL KNOCK DURING ACCELERATION	
Possible cause	**Remedy**
Poor fuel quality.	Drain fuel, rinse the fuel system, replace the fuel filters and fill the fuel tank with fuel.
Air in the fuel system.	Check the fuel system for drawing in air: - through suction pipe - through sealing ring of fuel lift pump.
Injector defective.	Check the injectors.
Fault in electrical components/wiring of: - sensor for engine coolant temperature - crankshaft position sensor.	Check the electrical system.

FAULT: ENGINE RUNS IRREGULARLY	
Possible cause	**Remedy**
Poor fuel quality.	Drain fuel, rinse the fuel system, replace the fuel filters and fill the fuel tank with fuel.
Air in the fuel system.	Check the fuel system for drawing in air: - through suction pipe - through sealing ring of fuel lift pump.
Fuel fine filter/fuel coarse filter blocked.	Replace the fuel fine filter and clean the system.
Connection points on pump units changed.	Install the correct connection points on the correct pump unit.
Mechanical defect or clogging of pump units.	Replace the pump units.
Injector defective.	Check the injectors.
Fuel lift pump output too low.	Check: - the fuel lift pump and replace, if necessary - gallery pressure.
Pressure-relief valve on pump housing does not shut off.	Check gallery pressure.
Fault in electrical components/wiring of: - pump unit - accelerator pedal sensor - sensor for engine coolant temperature - boost pressure sensor - fuel temperature sensor - connectors.	Check the electrical system.

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FAULT: REDUCED POWER AT ALL SPEEDS	
Possible cause	**Remedy**
Poor fuel quality.	Drain fuel, rinse the fuel system, replace the fuel filters and fill the fuel tank with fuel.
Fuel fine filter/fuel coarse filter blocked.	Replace the fuel fine filter and clean the system.
Pompunits mechanisch defect of verstopt.	Replace the pump units.
Accelerator pedal sensor, mechanical defect.	Check: - mechanical connection sensor/accelerator pedal - accelerator pedal sensor.
Mechanical defect or clogging of pump units.	Replace the pump units.
Injector defective.	Check the injectors.
Pressure-relief valve on pump housing does not shut off.	Check gallery pressure.
Fuel lift pump output too low.	Check: - the fuel lift pump and replace, if necessary - gallery pressure.
Fault in electrical components/wiring of: - accelerator pedal sensor - sensor for engine coolant temperature - boost pressure sensor - fuel temperature sensor - connectors.	Check the electrical system.

FAULT: REDUCED POWER ABOVE A PARTICULAR SPEED	
Possible cause	**Remedy**
Fuel fine filter/fuel coarse filter partially blocked.	Replace the fuel fine filter and clean the system.
Mechanical defect or clogging of pump units.	Replace the pump units.
Air leaks in inlet system.	Pressure-test the inlet system.
Pressure-relief valve on pump housing does not shut off.	Check gallery pressure.
Fuel lift pump output too low.	Check: - the fuel lift pump and replace, if necessary - gallery pressure.
Fault in electrical components/wiring of: - electro-pneumatic boost pressure valve - connectors.	Check the electrical system.

FAULT: WHITE/BLUE SMOKE DEVELOPMENT	
Possible cause	**Remedy**
Slechte brandstofkwaliteit.	Drain fuel, rinse the fuel system, replace the fuel filters and fill the fuel tank with fuel.
Air in the fuel system.	Check the fuel system for drawing in air: - through suction pipe - through sealing ring of fuel lift pump.
Fuel fine filter/fuel coarse filter blocked.	Replace the fuel fine filter and clean the system.
Mechanical defect or clogging of pump units.	Replace the pump units.
Injector defective.	Check the injectors.
Fuel lift pump output too low.	Check: - the fuel lift pump and replace, if necessary - gallery pressure.
Fault in electrical components/wiring of: - crankshaft position sensor - sensor for engine coolant temperature - connectors.	Check the electrical system.

FAULT: BLACK SMOKE DEVELOPMENT	
Possible cause	**Remedy**
Injector defective.	Check the injectors.
Fault in electrical components/wiring of: - crankshaft position sensor - air inlet temperature sensor - fuel temperature sensor - boost pressure sensor.	Check the electrical system.

FAULT: ENGINE OVERHEATED	
Possible cause	**Remedy**
Poor fuel quality.	Drain fuel, rinse the fuel system, replace the fuel filters and fill the fuel tank with fuel.
Fault in electrical components/wiring of: - sensor for engine coolant temperature.	Check the electrical system.

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FAULT: FUEL CONSUMPTION TOO HIGH	
Possible cause	**Remedy**
Poor fuel quality.	Drain fuel, rinse the fuel system, replace the fuel filters and fill the fuel tank with fuel.
Fuel fine filter/fuel coarse filter blocked.	Replace the fuel fine filter and clean the system.
Mechanical defect or clogging of pump units.	Replace the pump units.
Injector defective.	Check the injectors.
Leaks in fuel system.	Check for leaks.
Fault in electrical components/wiring of: - sensor for engine coolant temperature - boost pressure sensor - fuel temperature sensor.	Check the electrical system.

FAULT: REDUCED MAXIMUM SPEED	
Possible cause	**Remedy**
Air in the fuel system.	Check the fuel system for drawing in air: - through suction pipe - through sealing ring of fuel lift pump.
Fuel fine filter/fuel coarse filter blocked.	Replace the fuel filter and clean the system.
Mechanical defect or clogging of pump units.	Replace the pump units.
Fuel lift pump output too low.	Check: - the fuel lift pump and replace, if necessary - gallery pressure.
Fault in electrical components/wiring of: - crankshaft position sensor - accelerator pedal sensor - sensor for engine coolant temperature.	Check the electrical system.

6. XE ENGINE INLET/EXHAUST SYSTEM

6.1 FAULT-FINDING TABLE

FAULT: REDUCED POWER AT ALL SPEEDS	
Possible cause	**Remedy**
Air filter clogged.	Replace or clean the air filter.
Turbocharger defective/incorrect wastegate control.	Check wastegate or wastegate control.
Electro-pneumatic boost pressure valve defective.	Check electro-pneumatic boost pressure valve.
Air leaks in inlet system.	Pressure-test the inlet system.

FAULT: REDUCED POWER ABOVE A PARTICULAR SPEED	
Possible cause	**Remedy**
Air filter partially clogged.	Replace or clean the air filter.
Electro-pneumatic boost pressure valve defective.	Check electro-pneumatic boost pressure valve.
Air leaks in inlet system.	Pressure-test the inlet system.

FAULT: FUEL CONSUMPTION TOO HIGH	
Possible cause	**Remedy**
Turbocharger defective.	Check the turbocharger.
Air leaks in inlet system.	Pressure-test the inlet system.

FAULT: REDUCED MAXIMUM SPEED	
Possible cause	**Remedy**
Turbocharger defective.	Check the turbocharger.

1

7. XE ENGINE BRAKE

7.1 FAULT-FINDING TABLE

FAULT: EXHAUST BRAKE DOES NOT ENGAGE	
Possible cause	**Remedy**
Compressor delivers insufficient air pressure.	Check the operation of the compressor.
Defective engine stop valve.	Check engine stop valve.
Air leak in the air pipe from air drier to engine stop valve.	Check air pipe.
Butterfly valve stuck in butterfly valve housing.	Check free movement of butterfly valve.
Defective engine stop operating cylinder.	Check operating cylinder.
Electrical fault.	Check electrical circuit.

FAULT: EXHAUST BRAKE REMAINS ENGAGED	
Possible cause	**Remedy**
Defective engine stop valve.	Check engine stop valve.
Defective engine stop operating cylinder.	Check operating cylinder.
Butterfly valve stuck in butterfly valve housing.	Check free movement of butterfly valve.
Electrical fault.	Check electrical circuit.

FAULT: DEB CANNOT BE SWITCHED ON	
Possible cause	**Remedy**
Electrical fault.	Check electrical circuit.
Engine oil pressure too low.	Check engine oil pressure.

FAULT: DEB REMAINS ENGAGED	
Possible cause	**Remedy**
Electrical fault.	Check electrical circuit.
Magnetic valve mechanically blocked.	Check magnetic valve.
Damaged magnetic valve sealing rings.	Replace all magnetic valve sealing rings.

FAULT: DEB OPERATES IRREGULARLY	
Possible cause	**Remedy**
Electrical fault.	Check electrical circuit.
Incorrect setting of DEB clearance.	Check DEB setting.
Main piston stuck in DEB housing.	Check free movement of main piston.
Operating piston stuck in DEB housing.	Check free movement of operating piston.
Damaged magnetic valve sealing rings.	Replace all magnetic valve sealing rings.
Magnetic valve oil strainer is blocked.	Clean magnetic valve oil strainer.
Control valve stuck in DEB housing.	Check free movement of control valve.
Defective control valve.	Check the operation of the control valve.
Lubricating oil too thick.	Run the engine at operating temperature.
Lubricating oil diluted with fuel.	Check lubricating oil for dilution.
Air bubbles in the oil.	Check the engine’s oil level/oil specification.
Oil duct plugs in DEB housing.	Clean/replace plugs.

CONTENTS

2

1. SAFETY INSTRUCTIONS

Diesel fuel is an extremely flammable liquid, and may not be exposed to open flames or brought into contact with hot parts. The diesel fuel fumes remaining in an empty fuel tank form an extremely explosive mixture.

When the fuel pipes are being removed, a quantity of fuel will escape. To keep this quantity of fuel as limited as possible, unscrew the fuel-tank cap to release any overpressure. Any spilled fuel must be collected, bearing in mind the risk of fire.

Do not run the engine in an enclosed or unventilated area.
Make sure exhaust fumes are properly extracted.

Maintain a safe distance from rotating and/or moving components.

Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard. This also applies to engine coolant, windscreen washer fluid, refrigerant in air-conditioning systems, battery acid and diesel fuel.
So avoid inhaling and direct contact.

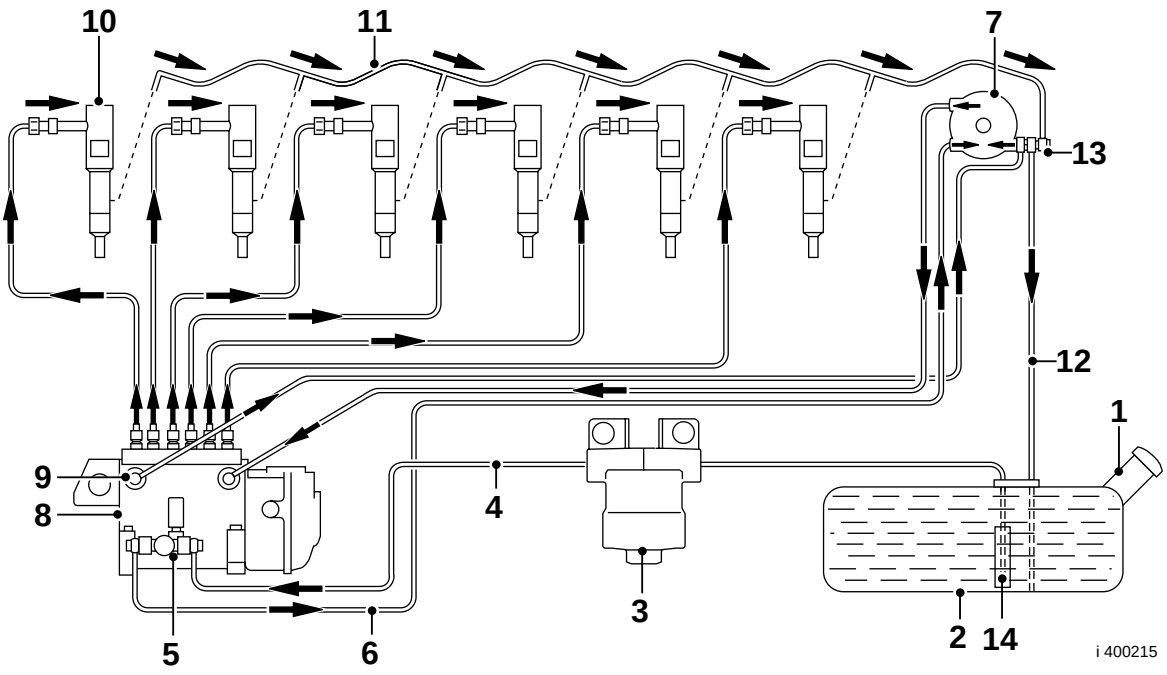
Exhaust gases contain carbon monoxide. Carbon monoxide is a deadly, colourless and odourless gas, which, when inhaled, deprives the body of oxygen, leading to asphyxiation. Serious carbon monoxide poisoning may result in brain damage or death.

It is recommended to always disconnect the battery's earth connection during repair or maintenance activities for which the power supply is not required.

2

2. GENERAL

2.1 OVERVIEW DRAWING OF FUEL SYSTEM



1. Filler cap
2. Fuel tank
3. Fuel prefilter
4. Supply pipe
5. Fuel lift pump
6. Delivery pipe
7. Fuel filter
8. Injector pump
9. Pressure-relief valve
10. Injector
11. Leak-off pipe
12. Return pipe
13. Non-return valve
14. Tank filter

2.2 DESCRIPTION OF FUEL SYSTEM

XF engines are equipped with an in-line injection pump with a mechanical regulator and a smoke limiter.
The exhaust control unit controls the fuel output in accordance with the boost pressure in the inlet manifold.
The mechanical regulator controls the fuel output in accordance with the engine load.

A manual fuel lift pump is fitted to bleed the low-pressure area of the system.

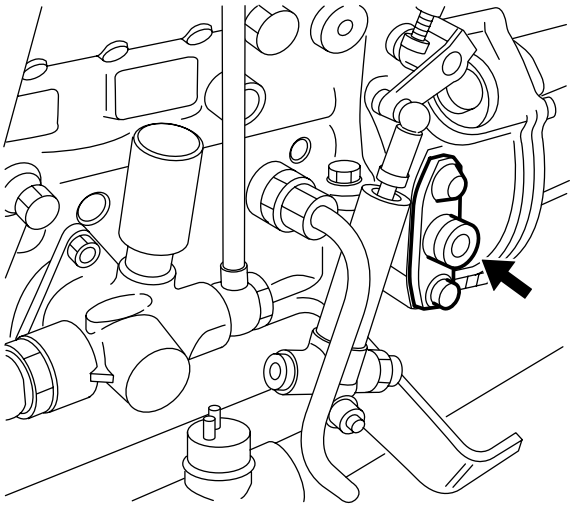
To achieve permanent bleeding of the low-pressure area, a banjo bolt with a calibrated hole has been installed in the head of the filter. A very small quantity of fuel will also escape through this calibrated hole. But because the hole is so small, and the fuel supply so large, pressure will be built up in the filter, and the fuel will be forced on to the fuel pump.

3. INSPECTION AND ADJUSTMENT

3.1 INSPECTION AND ADJUSTMENT OF INJECTION TIMING

Inspecting the pump timing

1. Remove the plug in the side of the fuel pump regulator housing. Collect the lubricating oil.
2. Insert the sensor of the special tool (DAF no. 1310455) as far into the hole as possible.
3. Connect the earth clamp of the tool to the fuel pump housing.



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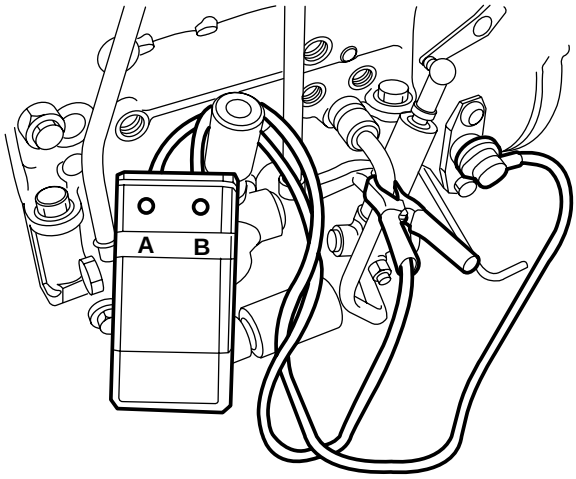
4. Use special tool (DAF no.1310477) to crank the engine slowly in the direction of rotation, until both LEDs (A and B) on the tool light up.
5. Remove the valve cover from cylinders 4, 5 and 6. Check whether the valves of cylinder 6 rock.
6. Check on the flywheel whether the pump timing is correct, see main group “Technical data”.



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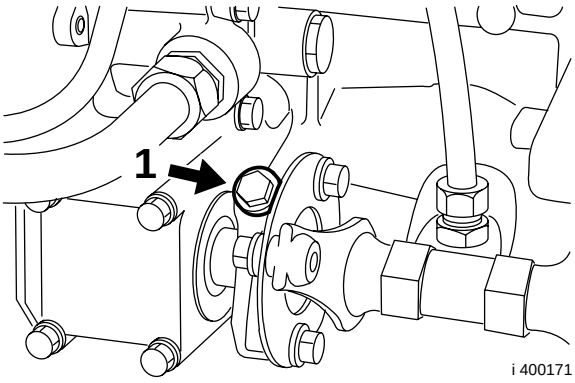
Setting the pump timing

1. Remove the valve cover from cylinders 4, 5 and 6.
2. Use special tool (DAF no. 1310477) to crank the engine slowly in the direction of rotation until the valves of cylinder 6 rock.
3. Use special tool (DAF no. 1310477) to crank the engine counter to the direction of rotation, through several degrees.
4. Use special tool (DAF no. 1310477) to crank the engine in the direction of rotation through the correct number of degrees (injection timing) before the top dead centre, see main group “Technical data”.
5. Remove the clamp bolt (1) from the clamp.



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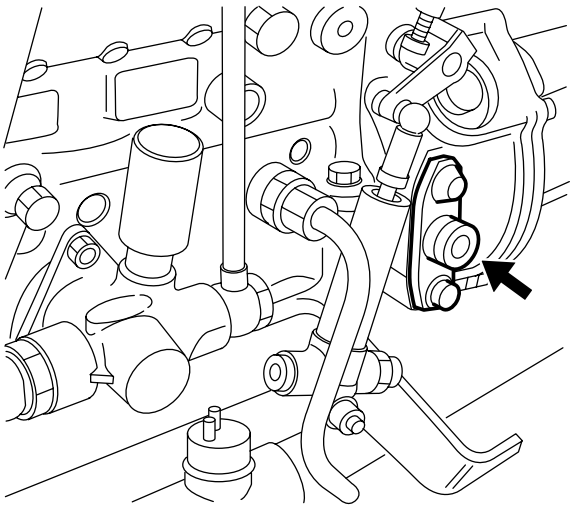
6. Remove the plug in the side of the fuel pump regulator housing. Collect the lubricating oil.
7. Insert the sensor of the special tool (DAF no. 1310455) as far into the hole as possible.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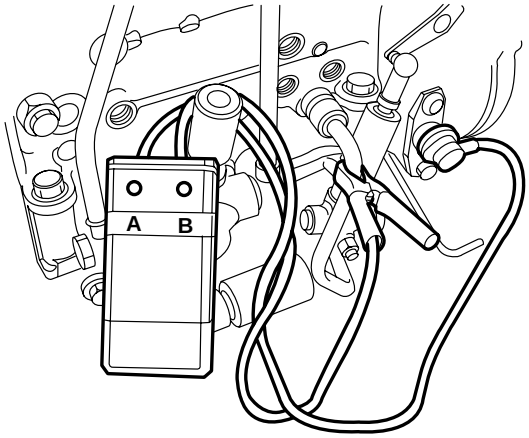
8. Connect the earth clamp of the tool to the fuel pump housing.
9. Crank the engine slowly in the direction of rotation until both LEDs (A and B) on the tool light up.



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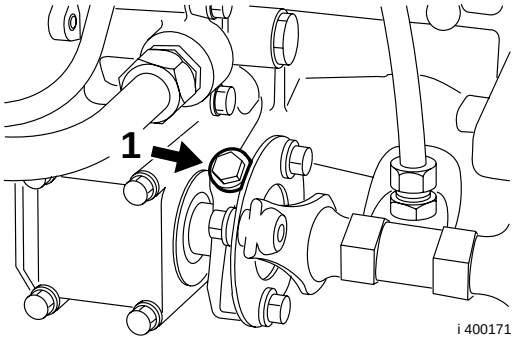
10. Install a new clamping bolt (1) in the clamp and tighten it to the specified tightening torque, see main group “Technical data”.



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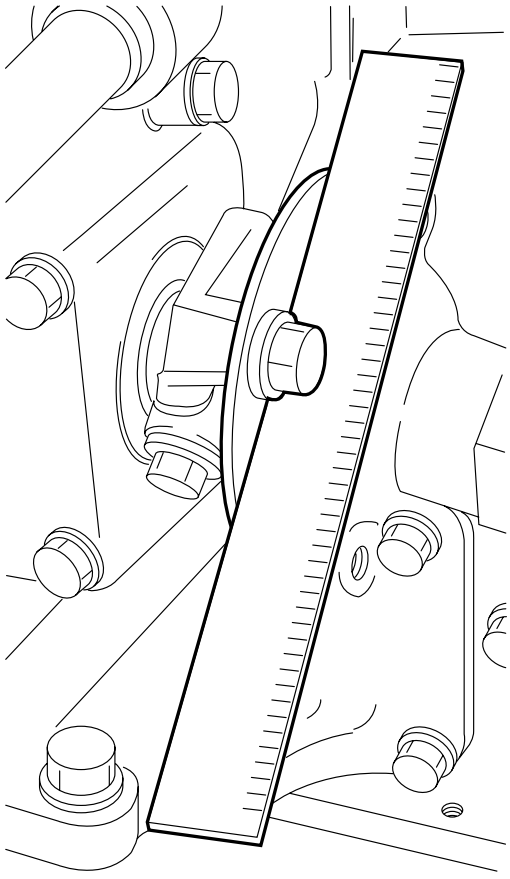
11. Check the clutch plates for cracking and whether they have been installed stress-free. If there is stress on the clutch plates, they will be “convex” or “concave”. Check using a steel measuring rod.
12. Remove the special tool from the fuel pump regulator housing. Install the plug with a new sealing ring.
13. Install the valve cover.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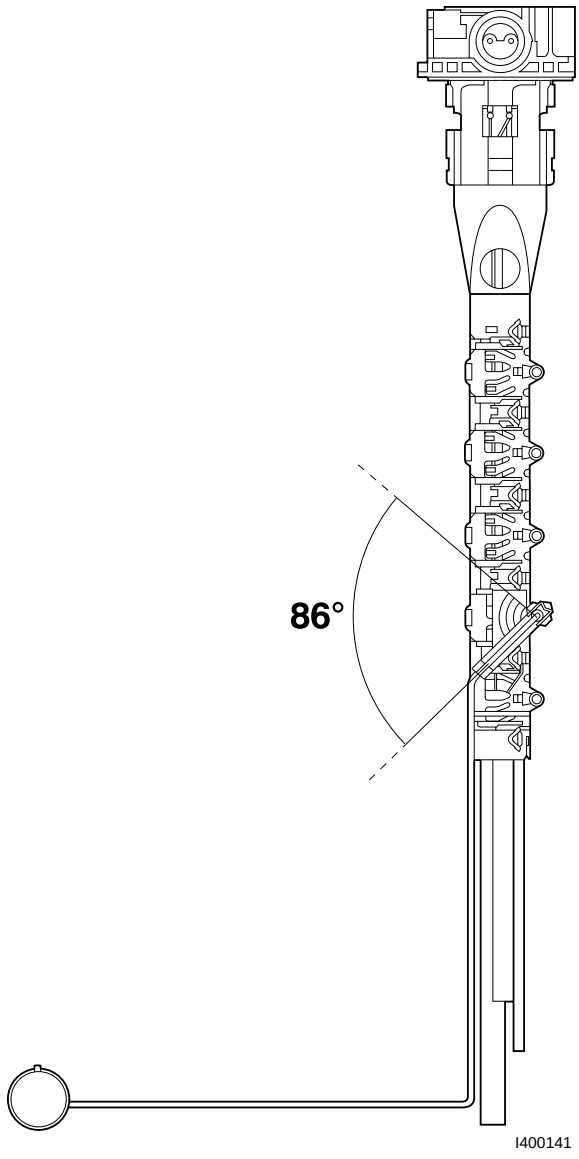
3.2 CHECKING THE FUEL LEVEL ELEMENT

To avoid deforming the fuel tank, the pressure in the fuel tank may not exceed 0.4 bar.

1. Fit a pressure reducing valve connection to a fuel filler cap (without bleeding) and connect it to the fuel tank.
2. Pressurise the fuel tank (maximum 0.2 bar).
3. Slowly increase the pressure, until one can hear the system blow off via the small overpressure valve and check the opening pressure of the fuel level element, see main group “Technical data”.
4. Depressurise the fuel tank and remove the fuel-tank cap with air connection.
5. **Note:**
   To prevent dirt from entering, first clean the exterior of the fuel tank.

   Remove the fuel level element.
6. Check the angular rotation of the fuel level element, see main group “Technical data”.



3.3 INSPECTION AND ADJUSTMENT OF INJECTOR OPENING PRESSURE

Fuel or test fluid discharged by an injector may penetrate the skin and be very harmful to your health. Make sure the fuel jet is discharged into a suitable container.

Checking the opening pressure with an injector test pump

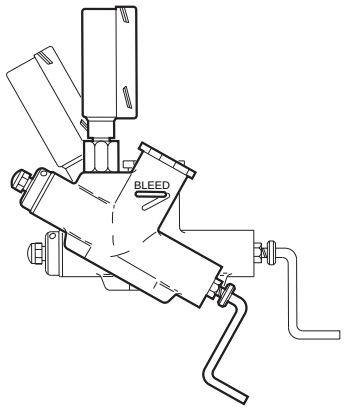
- The opening pressures of the injectors can be tested using an injector test pump (DAF no. 0694966). The advantage of this method is that the injectors need not be removed from the engine.

Instructions for the use of the injector test pump

Before the injector testing pump is used, it must first be bled.

1. Remove the pump reservoir filler cap and fill the reservoir with test fluid. The fluid level must be approximately 1 cm beneath the top rim.

2. Tilt the pump until the line with the word **"BLEED"** is in a horizontal position.

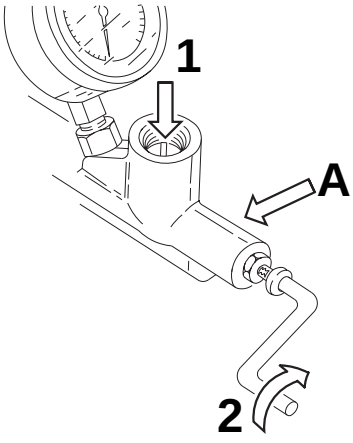


M4059

3. Depress the bleed pin (1) and simultaneously turn the crank (2) clockwise to the stop.
   During this operation, air bubbles will come to the surface in the reservoir. Now turn back the crank, fill the reservoir again and turn the crank until no more air bubbles come to the surface.
   Now release the bleed pin. Continue turning the crank until fuel escapes on the delivery side.

4. If necessary, fill the fuel reservoir and screw back the cap.

5. The pump is now ready for use.



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Inspecting the injector opening pressure

1. Remove the injection lines in sets of three, see chapter “Removal and installation”. Immediately plug the connection openings on the fuel pump.

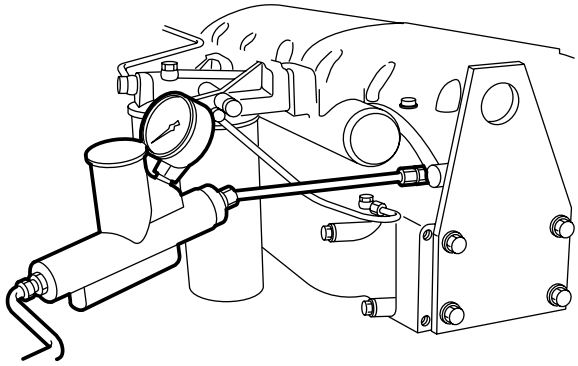
2. Connect the injection line (supplied with the injector test pump) to the injector to be tested and to the test pump. Keep the test pump approximately in horizontal position.

3. Loosen the test pump filler cap by half a turn, so that air can enter the reservoir.

4. Turn the crank of the test pump clockwise. The compression stroke starts. Watch the fluid level in the test pump.

5. Carefully determine the opening pressure of the injector. There is no harm in repeating the test twice or three times. If the test is repeated too often however, the test fluid deposited on the piston may cause damage to the engine when it is started.

6. Reinstall the injection lines after the injector(s) has (have) been tested, see chapter “Removal and installation”.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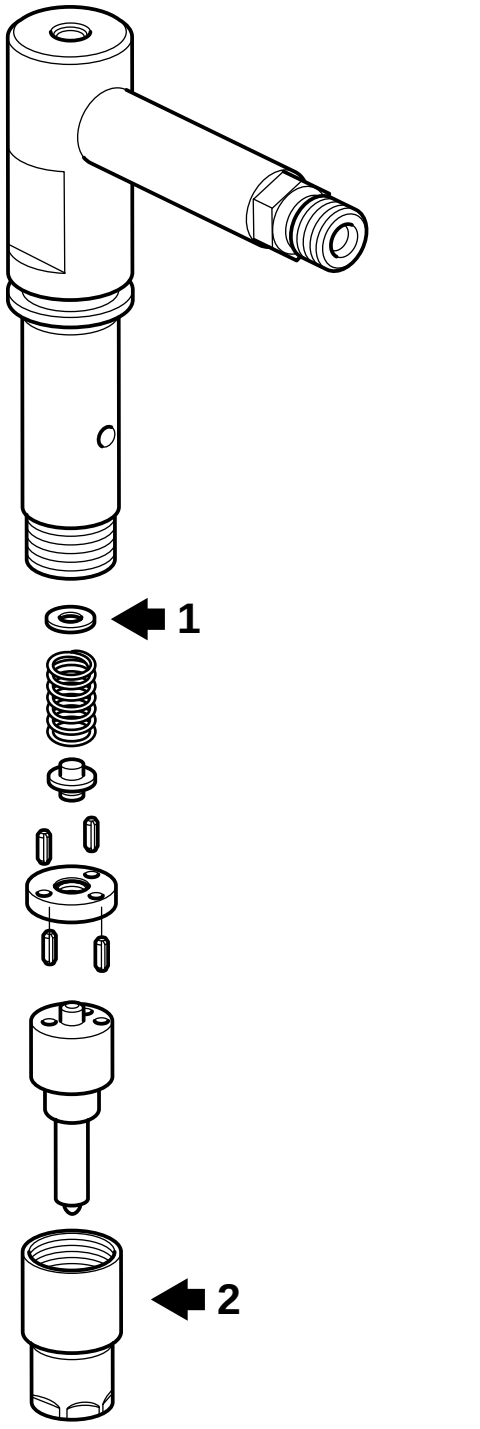
Adjusting the injector opening pressure

Note:
The test pump can also be used to test injectors outside the engine. The bottom of the test pump can be clamped in a vice without causing damage to the test pump.

1. Remove the injector, see chapter “Removal and installation”.
2. Disassemble the injector, see chapter “Disassembly and assembly”.
3. Adjust the opening pressure by fitting a thicker or thinner shim (1). For pressure settings, see main group “Technical data”.

   Note:
   An increased shim thickness of 0.01 mm raises the pressure by approx. 1.5 bar.
4. Assemble the injector, see chapter “Disassembly and assembly”.
5. Fit the injector, see chapter “Removal and installation”.



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3.4 INSPECTION OF INJECTOR OPERATION

Fuel or test fluid discharged by an injector may penetrate the skin and be very harmful to your health. Make sure the fuel jet is discharged into a suitable container.

2

Evaluating the spray pattern, spray angle, and sound is practically impossible. New injectors or injectors which have been used for some time cannot be tested in this way.

1. Place the injector on an injector tester.
2. First allow the injector to inject a number of times.
3. Check the injector for:
   - opening pressure
   - leaks
   - nozzle holes.

Opening pressure

1. Check the opening pressure by slowly building up the pressure inside the injector.

Leaks

1. Dry the nozzle immediately after the final injection.
2. Increase the pressure to the opening pressure minus 20 bar. Within approx. 10 seconds, fuel must have ceased to leak from the nozzle. A moist nozzle is permitted. If the injector does not pass the fuel leakage test, the injector body (nozzle) must be replaced.

Nozzle holes

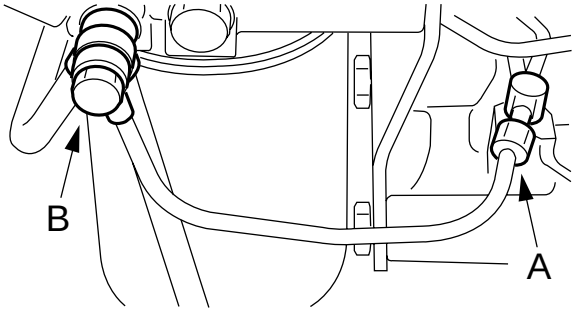
1. Quickly build up pressure in the injector and check whether all the holes are fully open.

3.5 INSPECTION OF FUEL SYSTEM FOR LEAKS

To avoid deforming the fuel tank, the pressure in the fuel tank may not exceed 0.4 bar.

1. Fit a pressure reducing valve connection to a fuel filler cap (without bleeding) and connect it to the fuel tank.
2. Dry the inspection points.
3. Pressurise the fuel tank (maximum 0.2 bar).
4. Open the union nut (A) a few turns to check whether the non-return valve is leaking into the banjo bolt (B). If it is leaking, this banjo bolt should be replaced.
5. Check the entire fuel system (low pressure area) for leakage.
6. Depressurise the system and replace the banjo bolt with integrated non-return valve in the filter head with a normal banjo bolt.
7. Remove the valve covers.
8. Re-pressurise the system (maximum 0.2 bar).
9. Check the leakage seal and the side connection of the injectors for leakage.

   Note:
   Engine oil may be used to detect leaks at the O-ring.
10. Fit the valve covers.
11. Replace the normal banjo bolt with a banjo bolt with integrated non-return valve.



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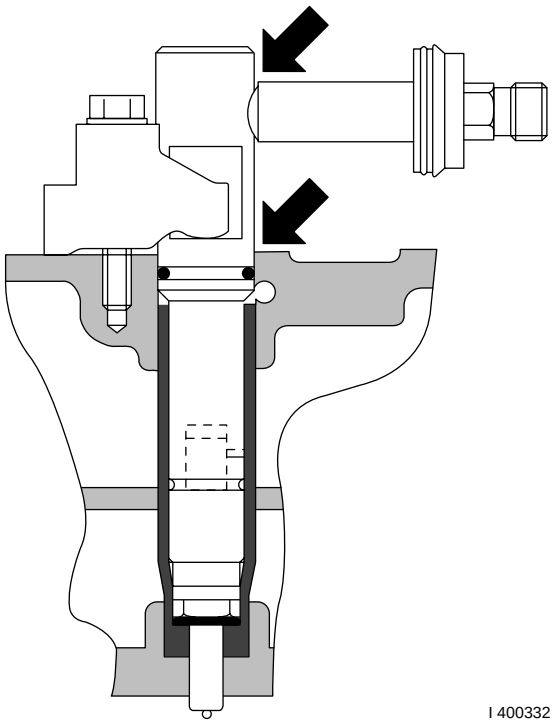
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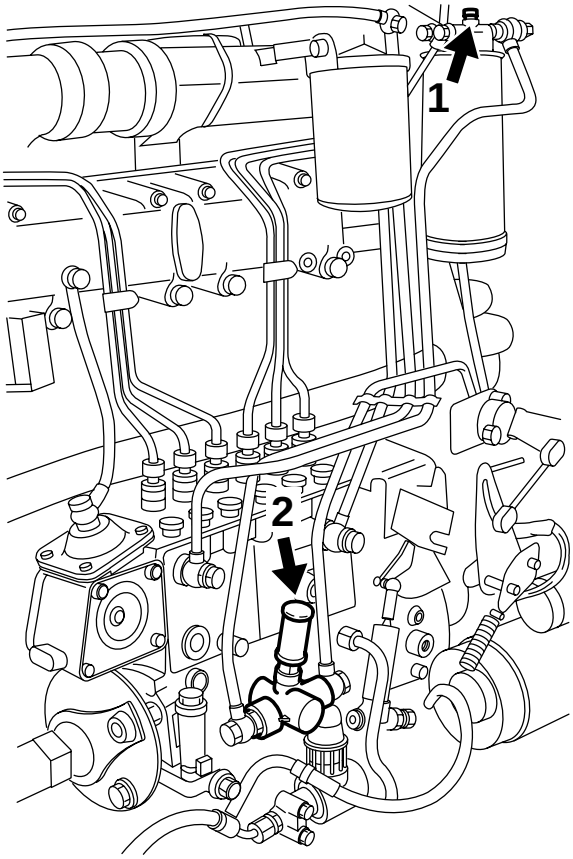
3.6 BLEEDING OF FUEL SYSTEM

Fuel is released during bleeding of the fuel system. This fuel must be collected, bearing in mind the risk of fire.

1. Open the bleed screw (1) on the filter body.
2. Using the hand pump (2), pump fuel through the system until fuel without air bubbles comes out of the bleed screw.
3. Close the bleed screw (1).



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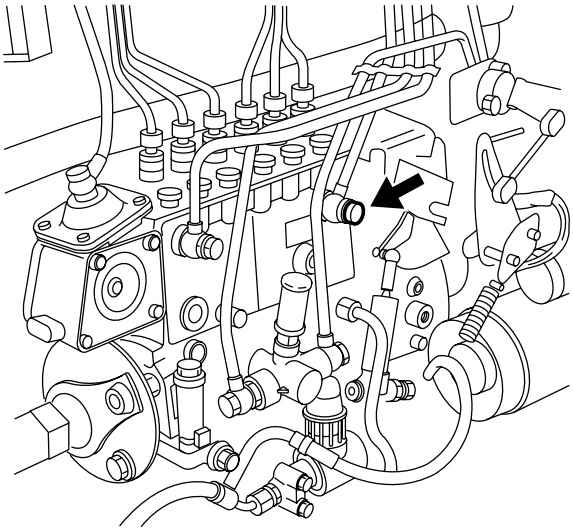
3.7 CHECKING OF GALLERY PRESSURE

Fuel is released when the gallery pressure is checked. This fuel must be collected, bearing in mind the risk of fire.

1. Remove the banjo bolt from the fuel pump supply pipe and replace it by a banjo bolt containing an extra connection.
2. Connect an attenuated pressure gauge with a range of up to 5 bar to the banjo bolt.
3. The weight of the vehicle should approximate the maximum combination weight.
4. Engine at operating temperature.
5. Select the highest gear but one.
6. Apply full throttle starting from approx. 900 rpm until the maximum loaded engine speed has been reached.
7. Measure the gallery pressure during acceleration and at maximum loaded engine speed. Compare the values as indicated. See “Technical data”.



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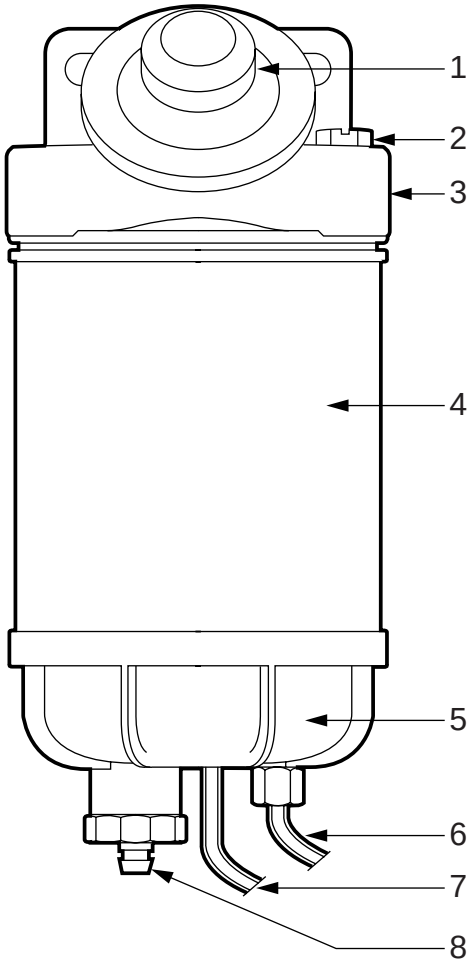
3.8 INSPECTION OF RACOR FILTER ELEMENT

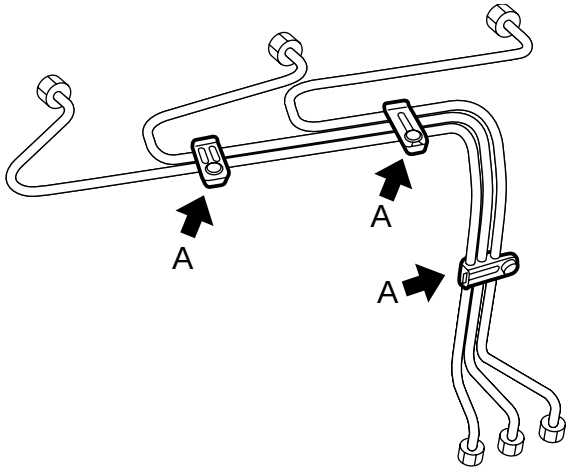
1. Check the reservoir for the presence of water.
2. If necessary, drain the water via plug (2) using the fuel lift pump (1).



4. REMOVAL AND INSTALLATION

4.1 REMOVAL AND INSTALLATION OF INJECTION LINES

Always leave the injection lines fixed together, as a complete set. Never remove or shift the clamping brackets (A) holding the lines together. Never bend injection lines as they may crack.



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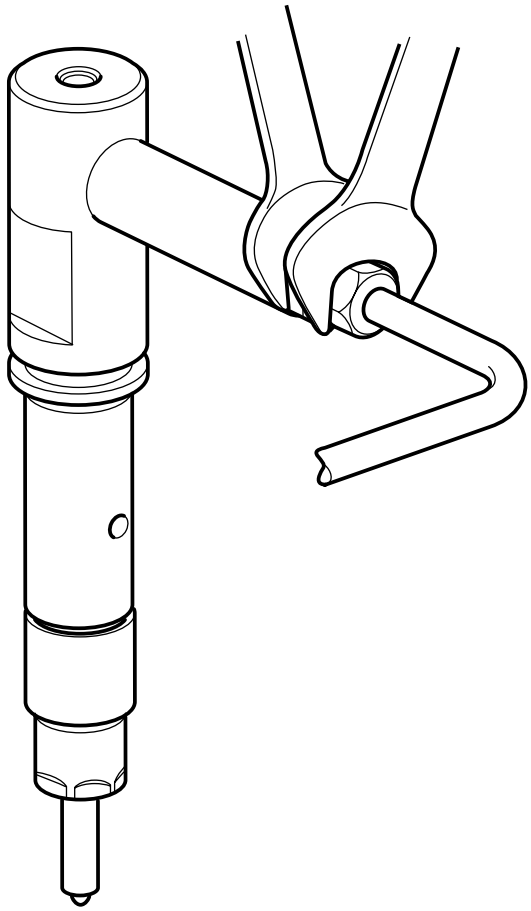
Removing the injection lines

1. Clean the unions and the area surrounding the injectors and the fuel pump.
2. **Note:**
   When slackening the injection-line unions, hold the injector's side connection back using an open-end spanner.

   Slacken the unions from the injection lines on the injector side.
3. Slacken the unions from the injection lines on the fuel-pump side.
4. Immediately plug the openings.
5. Remove the injection lines.



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Installing the injection lines

1. Purge the injection lines with dry compressed air.
2. Check whether the injector side connection is tightened to the specified tightening torque, see main group “Technical data”.
3. Fit the injection lines.
4. **Note:**
   When tightening the injection-line unions, hold the injector’s side connection back using an open-end spanner.

   Tighten the union nuts of the injection lines to the specified tightening torque, see main group “Technical data”.

4.2 REMOVAL AND INSTALLATION OF INJECTORS

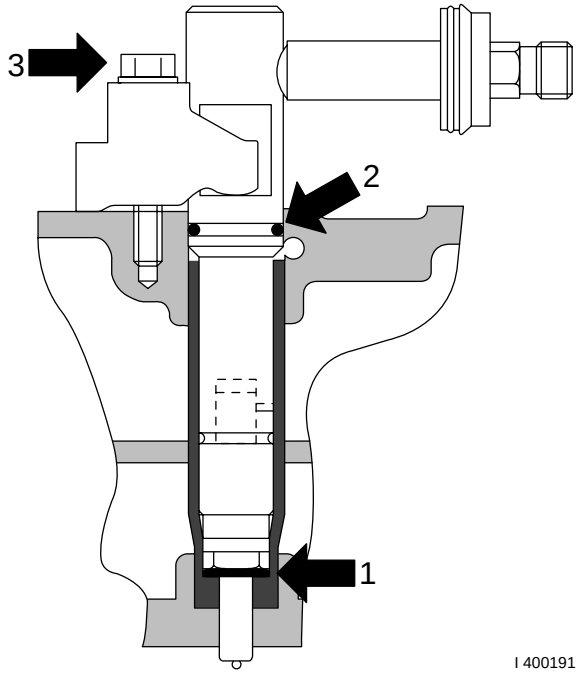
Because there is overpressure in the fuel tank, fuel may penetrate the cylinders when the injectors are removed. Therefore, when removing injectors, always take off the fuel-tank cap first. Collect any fuel leaving the injectors.

Note:
If the engine has been fitted with a DEB, the latter must be removed before the injectors can be removed.
While the DEB is being installed, both the DEB clearance and the valve clearance must be set.

Removing the injectors

1. Remove the injection lines.
2. Remove the valve covers.
3. Remove the DEB, if applicable.
4. Remove the attachment bolt (3) of the injector clamp.
5. To remove the injector and the clamp, **only** use the special tools (DAF no. 1329412 and DAF no. 0694928).

   Note:
   If during removal one or more copper shims (1) remain in the injector sleeve, the injector will be reinstalled in a higher position.
   - As a result, instead of spraying into the combustion chamber of the piston, the fuel will be sprayed onto the piston ring. This may seriously damage the piston.
   - There will be inadequate sealing between the O-ring (2) of the injector and the cylinder head. Fuel leaking from the injector can freely flow into the engine and dilute the lubricating oil.



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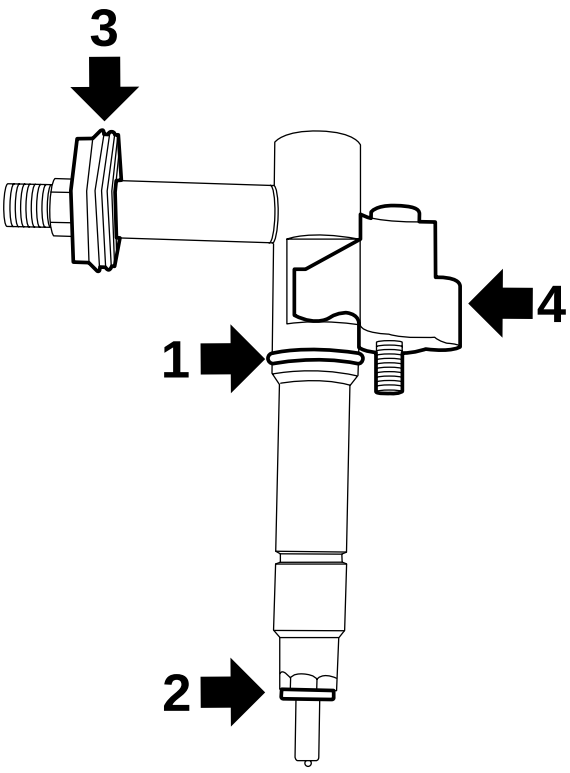
Installing the injectors

1. Clean the injector sleeve, see chapter “Cleaning”.
2. Fit a new O-ring (1) and a new copper shim (2) on the injector. Apply a little acid-free grease to both rings.
3. Check the valve-sleeve sealing ring (3) of the injector. Replace it if leaking and/or damaged.
4. **Note:**
   Make sure that the injector clamp (4) is installed correctly.

   Install the injector together with the injector clamp (4) and tighten the attachment bolt to the specified tightening torque, see main group “Technical data”.
5. Fit the injection lines.
6. Check the injector seals for leaks, see “Checking and adjustment”.
7. Install the DEB, if present.
8. Fit the valve covers.



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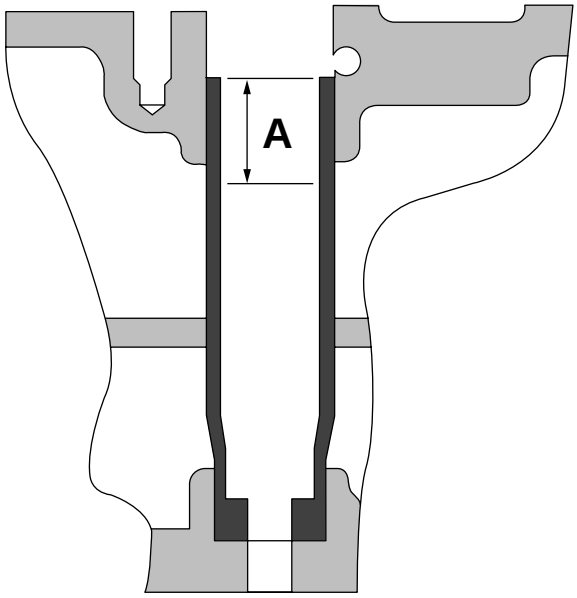
4.3 REMOVAL AND INSTALLATION OF INJECTOR SLEEVES

Removing the injector sleeve

1. Drain part of the engine coolant.
2. Remove the injection lines.
3. Remove the injector.
4. Insert a ball of crumpled paper into the injector sleeve to prevent metal particles from entering the engine.
5. Cut thread (M22 × 1.5) in the injector sleeve to be removed over a length (A) of approx. 20 mm.
6. Insert the special tool (DAF no. 1310425) into the injector sleeve and use the special tool (DAF no. 0694928) to remove the injector sleeve.



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Installing the injector sleeve

1. Clean the injector-sleeve opening thoroughly.
2. **Note:**
   Install the injector sleeve **dry** into the cylinder head.

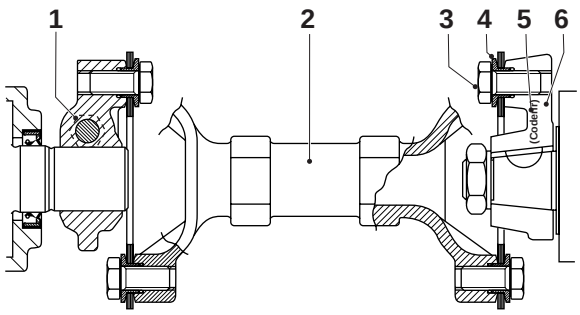
   Use the special tool (DAF no. 1329305) to tap the injector sleeve into the cylinder head.
3. Install the injector.
4. Fit the injection lines.
5. Fill the cooling system.

4.4 REMOVAL AND INSTALLATION OF FUEL PUMP

When removing the fuel pump, a quantity of fuel will escape. This fuel must be collected, bearing in mind the risk of fire.

Removing the fuel pump

1. Disconnect the smoke limiter pipe.
2. Remove the fuel supply and discharge pipes on the fuel feed pump.
3. Remove the injection lines.
4. Remove the oil supply and return lines.
5. Remove the air cylinder from the fuel pump stop control.
6. Remove the attachment bolts (3) and the bushes (4) by means of which the fuel pump coupling (2) is attached to the drive flange (6).
7. Remove the fixing bolts of the fuel pump.
8. Remove the fuel pump from the pump pedestal.

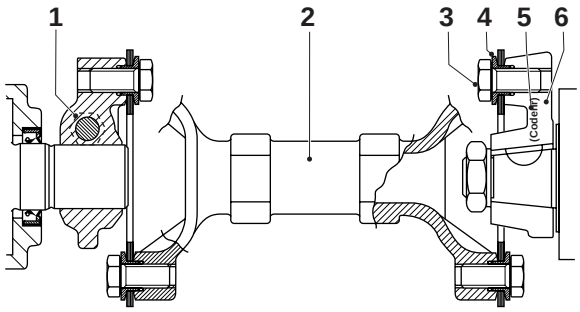


I4 00 405

Installing the fuel pump

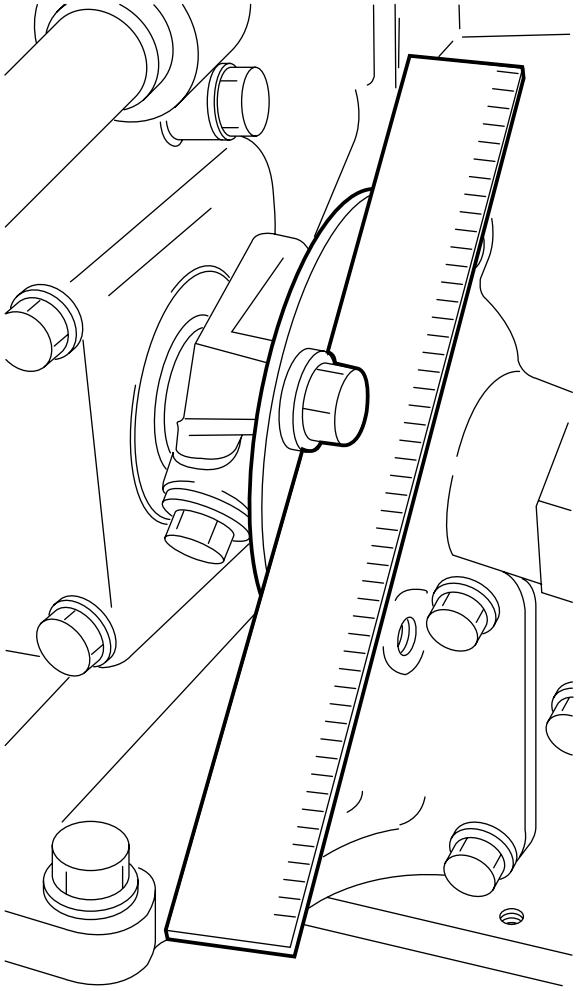
1. Use the special tool (DAF no. 1310477) to crank the engine in the rotational direction until the mark on the flywheel (in degrees before TDC) indicates the injection time of cylinder 1, see main group “Technical data”.
2. Remove the valve cover from cylinders 4, 5 and 6.
3. Check whether the valves of cylinder 6 are in rocking position.
4. Check the clutch plates of the fuel pump.
5. Clean the threaded holes for the attachment bolts (3) in the drive flange (6).
6. Remove the clamp bolt (1) from the clamp and open the slot of the clamp.
7. Make sure the clamping surfaces of shaft and clamp are free from grease.
8. Install the pump on the pump pedestal.
9. Insert the four fixing bolts of the pump. Cross tighten the attachment bolts to the specified torque. See main group “Technical data”.
10. Turn the drive flange (6) of the fuel pump so that the code number (5) is positioned opposite the bolt (1) of the clamp.
11. **Note:**
    Attachment bolts should not be reused; **always** use new bolts.

    Install the bushes (4) and fit the attachment bolts (3). Tighten the fixing bolts to the specified torque. See main group “Technical data”.



I4 00 405

12. Install a new clamping bolt (1). Tighten the clamping bolt (1) to the specified torque, see main group “Technical data”.
13. Check the clutch plates for cracking and whether they have been installed stress-free. If there is stress on the clutch plates, they will be ‘convex’ or ‘concave’. Check using a steel measuring rod.
14. Adjust the injection timing, see chapter “Checking and adjusting”.
15. Install the stop control and check its setting.
16. Install the oil supply and return lines.
17. Fit the injection lines.
18. Install the smoke limiter pipe.
19. Install all fuel supply and return lines.
20. Install the valve cover of cylinders 4, 5 and 6.

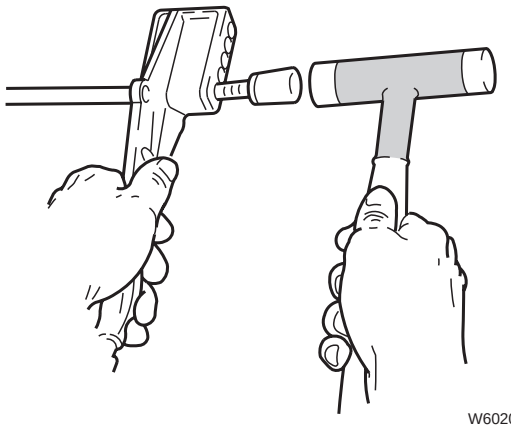


i 400184

4.5 REMOVAL AND INSTALLATION OF FUEL PIPES

1. Cut off the pipe behind the nipple or banjo union. Remove the section of pipe from the nipple or banjo union, by heating. Never remove the nipple or banjo union by making an incision in the longitudinal direction of the pipe. This could easily result in damage to the hose adapter. Even minor damage to the hose adapter will cause leakage.
2. It is not permitted to fit a nipple or banjo union to the same pipe end more than once. If a nipple or banjo union were fitted to the same pipe end more than once, this could result in bad sealing.
3. Cut off the pipe end if it has been used before. If shortening the pipe results in a sharp curve in the pipe or if it makes the pipe too short, the pipe will have to be extended or a new pipe will have to be fitted.
4. Always install nipples and banjo unions in plastic pipes with the special tool (DAF no. 0694829).
5. Clamp the plastic pipe in the special tool.
6. **Note:**
   Never heat a plastic pipe when fitting nipples or banjo unions.

   Use a plastic mallet to tap the nipple or banjo union into the pipe.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Leaks from fuel pipes must be remedied as soon as possible to prevent fire risk.

In the event of a leakage from a pipe coupling, unlimited tightening of the union nut is not permitted.

1. First check whether the leak is at the connection point between the pipe and coupling or at the connection point between coupling and the component housing.
2. The union nut may be tightened a further half turn (180°) only once. Tightening the union nut further than this is possible, but entails the risk of excessive deformation of the thrust washer and the pipe, which would seriously weaken the pipe.
3. If the leakage has not stopped after the union nut has been tightened, it will be necessary to take the coupling apart.
4. Check the parts for deposits and/or damage. Even a small longitudinal scratch on the pipe adapter of a nipple or a banjo union may be sufficient to cause a leak.

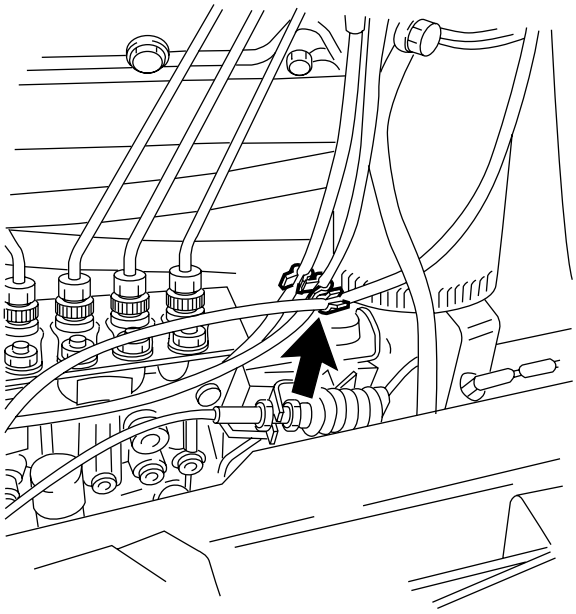
When pipes touch each other or other parts of the vehicle, they may get chafed.

1. Pipes showing evidence of wear must be replaced without delay.
2. When pipes are fitted close together or close to other parts of the vehicle, they should be secured to prevent chafing.
3. Secure pipes with the specially developed pipe clips. These pipe clips are available for pipes with a diameter of 6, 10 and 22 mm. The pipe clips can be joined together.

Clip diameter	DAF no.
6	0761460
10	0761462
22	0761461

4. Chafing can sometimes be prevented by releasing an elbow or T-piece and then tightening it in a slightly different position.
5. **Note:**
   Do not over tighten the cable ties, or the pipes may be forced shut.

   Secure the pipes with cable ties.



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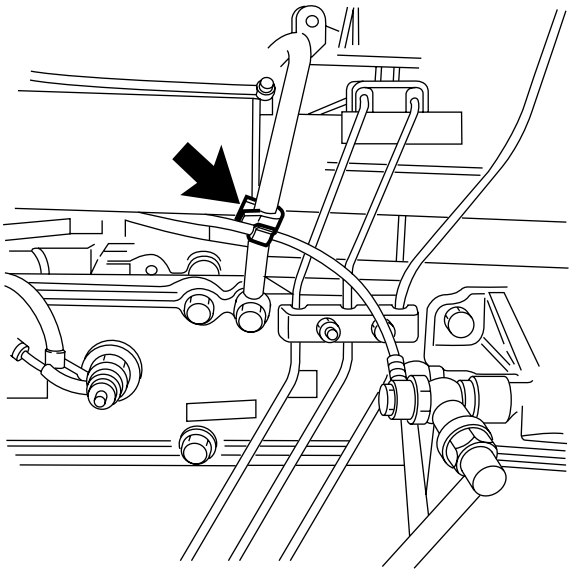

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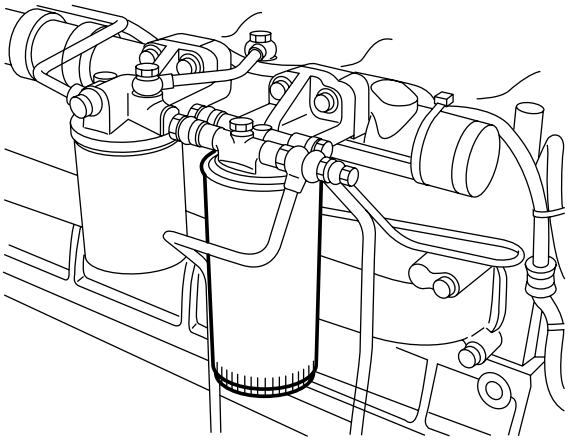
4.6 REMOVAL AND INSTALLATION, FUEL FILTER

When the fuel filter is removed, a quantity of fuel will escape. This fuel must be collected, bearing in mind the risk of fire.

Removing the fuel filter

1. Place a tray beneath the filter to collect any escaping fuel.
2. Remove the filter by turning it counter-clockwise.

   Note:
   The fuel filter is a disposable filter, and must neither be cleaned nor reused.



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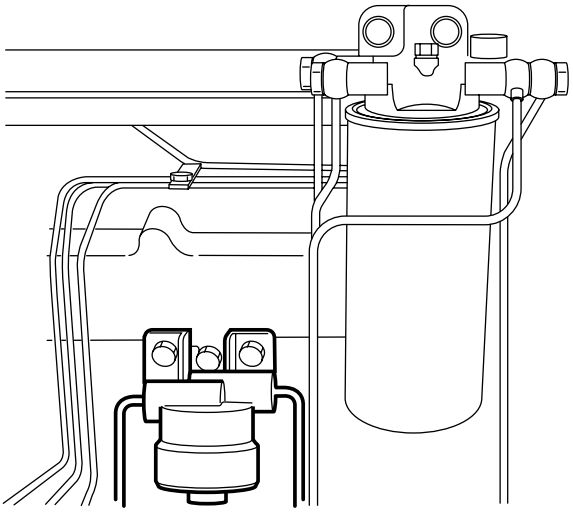
Installing the fuel filter

1. Fill the new fuel filter with clean diesel fuel.
2. Lightly lubricate the sealing ring with engine oil.
3. Fit the filter until the sealing ring abuts and then tighten the filter by hand another $^{1}/_{2}$ to $^{3}/_{4}$ turn.
4. Bleed the fuel system, if necessary. See chapter “Inspection and adjustment”.
5. Start the engine and check for leaks. Manually re-tighten the filter, if necessary.

4.7 REMOVAL AND INSTALLATION OF FUEL PREFILTER

When the fuel prefilter is removed, a quantity of fuel will escape. This fuel must be collected, bearing in mind the risk of fire.



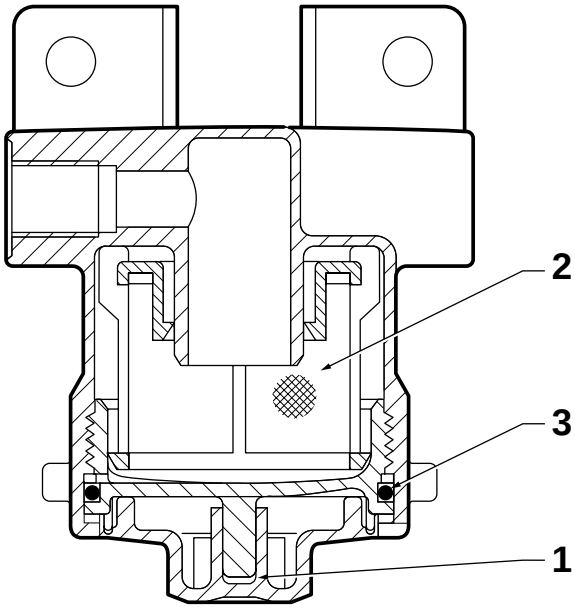
Removing the fuel prefilter

1. Place a tray beneath the fuel prefilter (2).
2. Remove the fuel-prefilter cover (1) by turning it counter-clockwise.
3. Remove the fuel prefilter (3).

Installing the fuel prefilter

1. Clean the fuel prefilter (2) and blow-clean it with compressed air.
2. Check the air-filter element for damage. If required, replace the fuel prefilter.
3. Check the sealing ring (3) for damage. If required, replace the sealing ring. Lightly lubricate the sealing ring with grease and install it.
4. Install the fuel prefilter.

Tighten the fuel-prefilter cover to the specified tightening torque, see main group “Technical data”.



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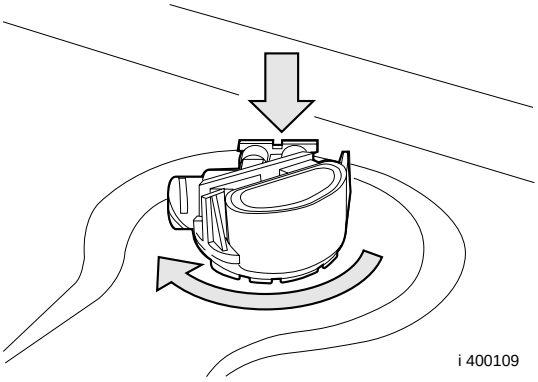
4.8 REMOVAL AND INSTALLATION OF FUEL LEVEL ELEMENT

Removing the fuel level element

1. To prevent dirt from entering, first clean the fuel tank.
2. Remove the connector from the fuel level element.
3. Remove the fuel pipes from the fuel level element.
4. Turn the fuel level element a quarter turn counter-clockwise.
5. Remove the fuel level element from the fuel tank.
6. Remove the O-ring.

Installing the fuel level element

1. Fit a new O-ring.
2. Check whether the fuel pipes are fitted correctly in the tank filter.
3. Fit the fuel level element carefully in the fuel tank.
4. Insert the fuel level element into the hole of the tank and turn it clockwise a quarter turn.
5. Insert the fuel pipes into the fuel level element.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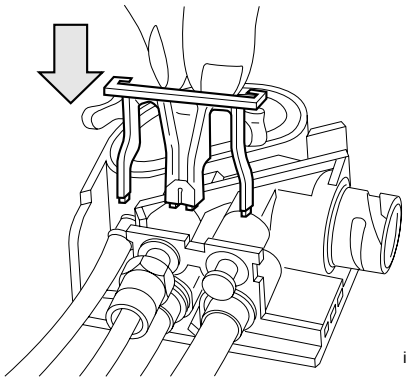
6. Install the connector of the fuel level element.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4.9 REMOVAL AND INSTALLATION OF TANK FILTER

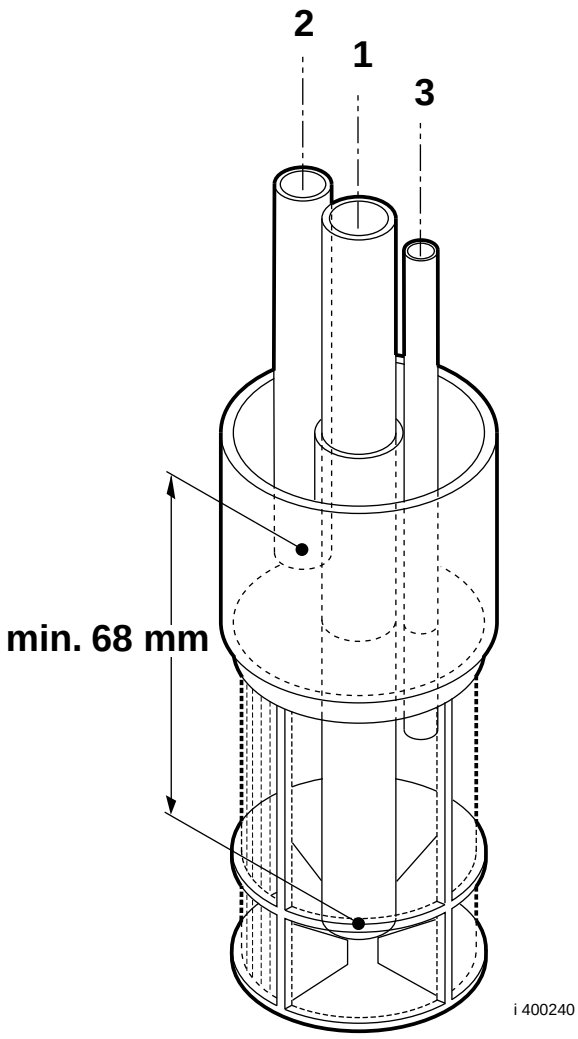
Removing the tank filter

1. Remove the fuel level element.
2. Remove the tank filter.

Installing the tank filter

1. Check that the difference in length between the supply line (1) and return line (2) is at least 68 mm.
2. Slide the tank filter as far as possible onto the supply line (1).

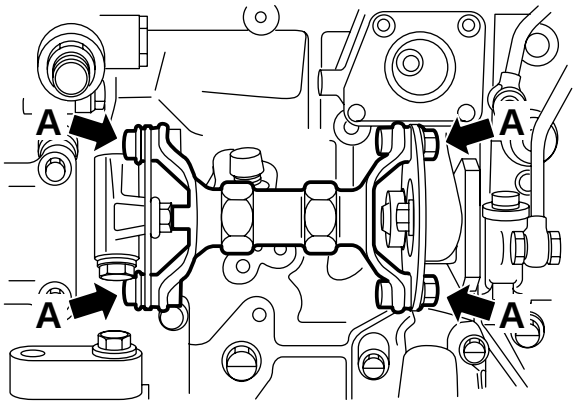
   Note:
   Make sure that the return line (2) is inserted into the tank filter by-pass as far as possible, and that the auxiliary heating supply line (3), if present, is inserted into the filter part.
3. Install the fuel level element.



4.10 REMOVAL AND INSTALLATION OF FUEL-PUMP DRIVE SEALING RING

Removing the fuel-pump drive sealing ring

1. Use the special tool (DAF no. 1310477) to crank the engine until the 1st cylinder injects, see main group “Technical data”.
2. Remove the fixing bolts (A) and the fuel pump control between the control housing and the fuel pump.



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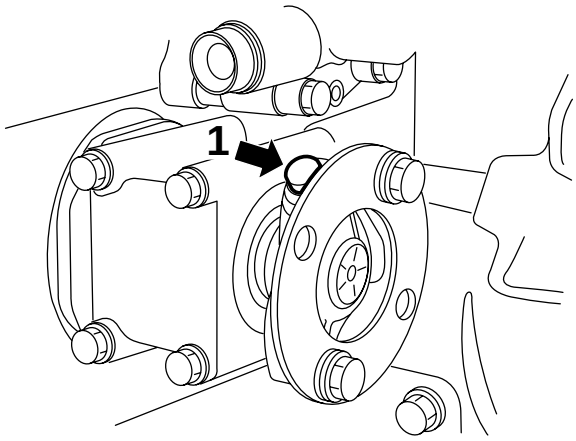
3. Remove the clamp bolt (1) from the clamp.
4. Remove the clamp from the drive shaft.



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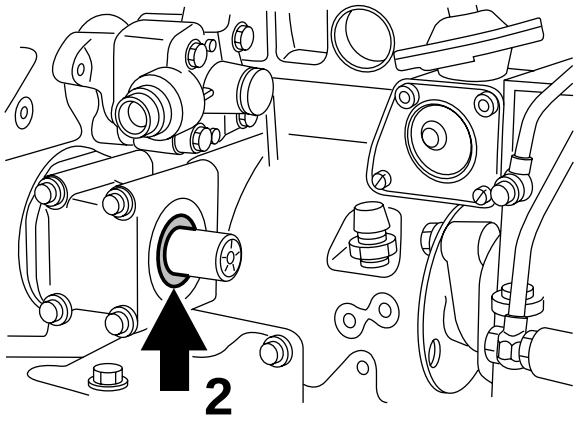
5. Remove the sealing ring with the special tools (DAF no. 0484899 and DAF no. 0694928).



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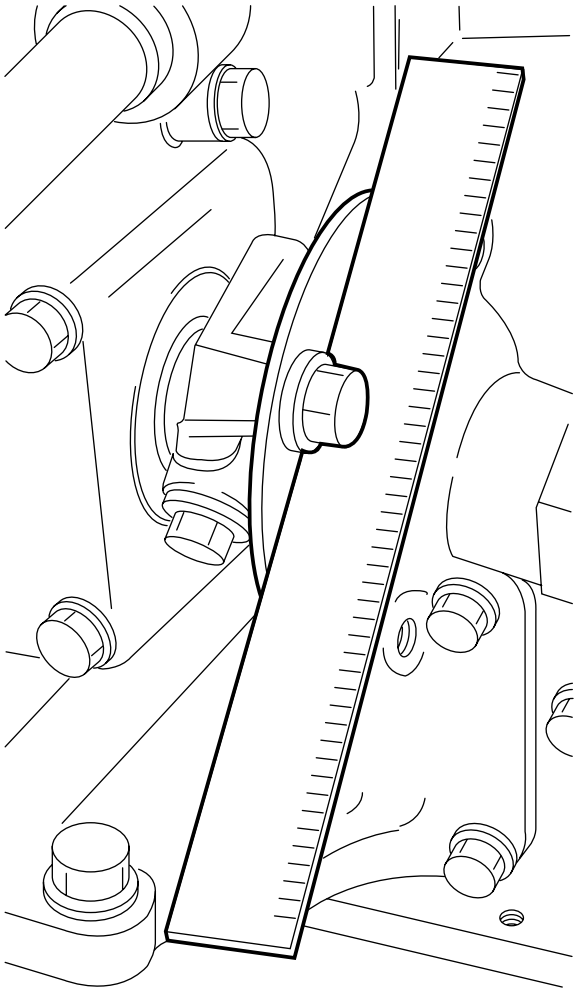
Installing the fuel-pump drive sealing ring

1. Clean the drive shaft and dry it.
2. Fit a dry new sealing ring using the special tool (DAF no. 1329308).
3. Open the slot of the clamp, allowing the coupling to be installed free of stress.
4. Install the clamp, fitted with a new clamp bolt (1), on the drive shaft.
5. Install the fuel-pump drive and the centring sleeves.
6. Install the fixing bolts (A) and tighten these to the specified tightening torque, see main group “Technical data”.
7. Adjust the injection timing, see chapter “Checking and adjusting”.
8. Check the clutch plates for cracking and whether they have been installed stress-free. If there is stress on the clutch plates, they will be “convex” or “concave”. Check using a steel measuring rod.



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4.11 REMOVAL AND INSTALLATION OF RACOR FILTER ELEMENT

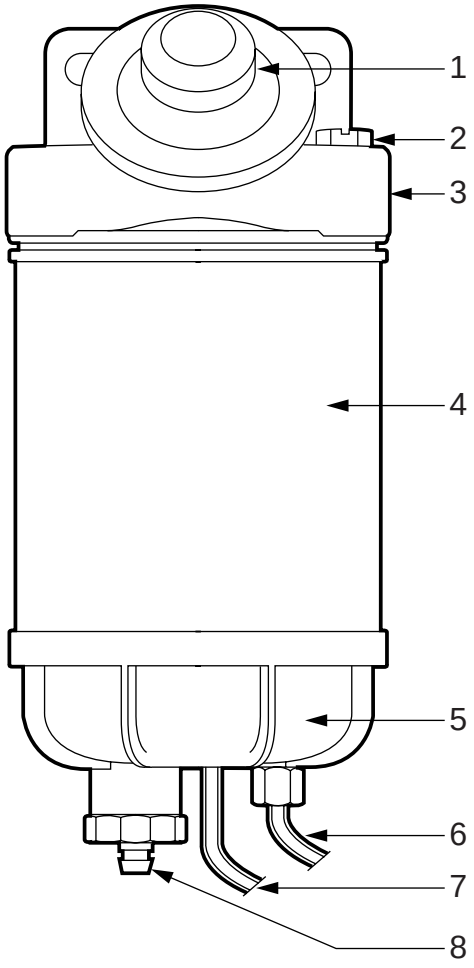
When the Racor filter element is removed, a quantity of fuel will escape. This fuel must be collected, bearing in mind the risk of fire.

Removing the Racor filter element

1. Drain the fuel from the filter element by loosening the bleeding plug (2) and opening the drain plug (8).
2. Loosen any connectors of the water sensor (6) and the heating element (7).
3. Remove the filter element (4) together with the bottom cover (5) and clean the O-ring sealing.

Installing the Racor filter element

1. Apply a film of engine oil to the O-ring and the new sealing ring.
2. Fit the bottom cover (5) to the new filter element (4) and fill clean diesel fuel.
3. Fit the bottom cover (5) together with the new filter element (4) to the filter housing (3).
4. Hand-tighten the filter.
5. Fit the water sensor connectors and the heating element, if present.



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5. DISASSEMBLY AND ASSEMBLY

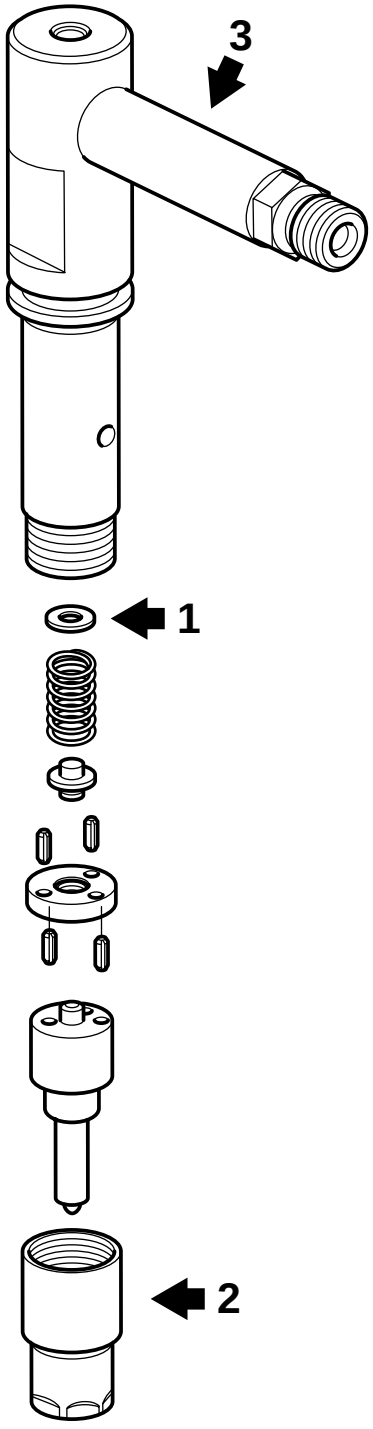
5.1 DISASSEMBLY AND ASSEMBLY OF INJECTOR

The injector side connection (3) must not be removed from the injector.

Disassembling the injector

1. Remove the injector, see chapter “Removal and installation”.
2. Clean the injector, see chapter “Cleaning”.
3. **Note:**
   Do not exchange injector bodies (nozzles) and injector needles because these constitute interrelated sets.

   Remove the union nut (2), after which the various parts can be taken from the injector.
4. Check that none of the injector parts have been compressed by the injector needle.



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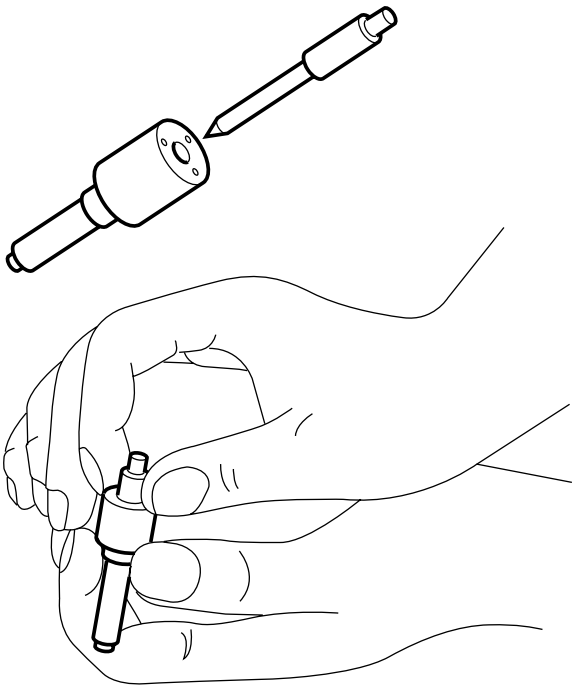
Assembling the injector

1. Immerse the injector needle and the injector body in clean diesel fuel.
   Insert the injector needle in the injector housing (nozzle).
   With the injector body held vertically, if the injector needle is lifted approx. 10 mm, it should slide downwards under its own weight.

2. Blow-clean all parts, and immerse them in clean diesel fuel.

3. **Note:**
   Ensure that there is no more diesel fuel on the screw thread, as it will cause the quality of the thread to deteriorate. Install the injector and tighten the union nut (2) to the specified tightening torque, see main group “Technical data”.

4. Check the opening pressure of the injector, see chapter “Inspection and adjustment”.



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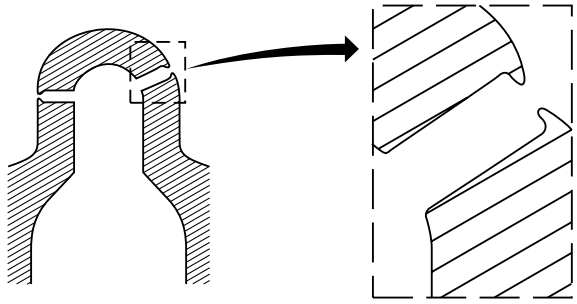
6. CLEANING

6.1 CLEANING INJECTOR

The injector must never be cleaned with a copper or steel wire brush. When cleaning the exterior of the injector nozzle, do not brush over the nozzle holes. If this is done nevertheless, the nozzle will have to be replaced.

The use of steel or copper wire brushes could lead to deformation of the nozzle holes as a result of which too little fuel would be injected. Such deformation cannot be detected by carrying out the normal injector test.



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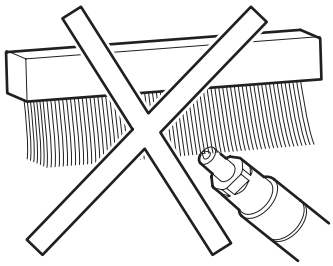
Cover the nozzle holes before cleaning the nozzle. Only clean the nozzle with the brass hand brush supplied with the injector cleaning set (DAF no. 1329371).



1. Determine the diameter of the injector nozzles to be cleaned, see main group “Technical data”.

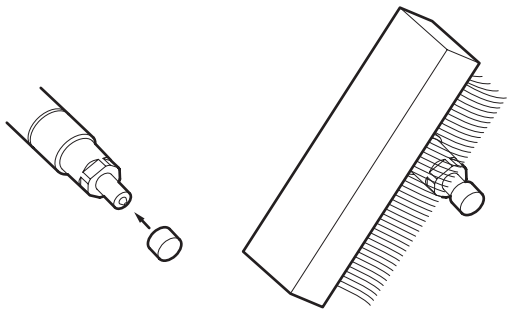
   Note:
   The diameter of the injector nozzles can be established using the nozzle number on the nozzle.

2. Disassemble the injector, see chapter “Disassembly and assembly”.

3. Clean the injector nozzles using an injector cleaning set (DAF no. 1329371).

   Note:
   The diameter of the needle must be approx. 0.02 mm less than the diameter of the nozzle.

4. Assemble the injector, see chapter “Disassembly and assembly”.



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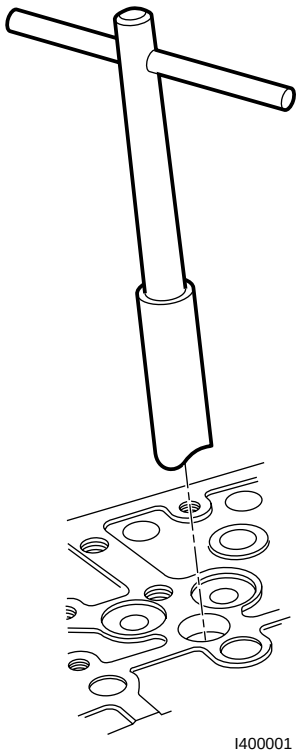
6.2 CLEANING INJECTOR SLEEVE

1. Remove the injector, see chapter “Removal and installation”.
2. Use the special tool (DAF no. 1240074) to remove any residual copper shim.
3. Use the special tool (DAF no. 1240074) to clean the injector sleeve.
4. Clean the injector sleeve with compressed air.
5. Fit the injector, see chapter “Removal and installation”.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CONTENTS

1. SAFETY INSTRUCTIONS

Do not run the engine in an enclosed or unventilated area.
Make sure exhaust fumes are properly extracted.

Maintain a safe distance from rotating and/or moving components.

Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard. This also applies to engine coolant, windscreen washer fluid, refrigerant in air-conditioning systems, battery acid and diesel fuel.
So avoid inhaling and direct contact.

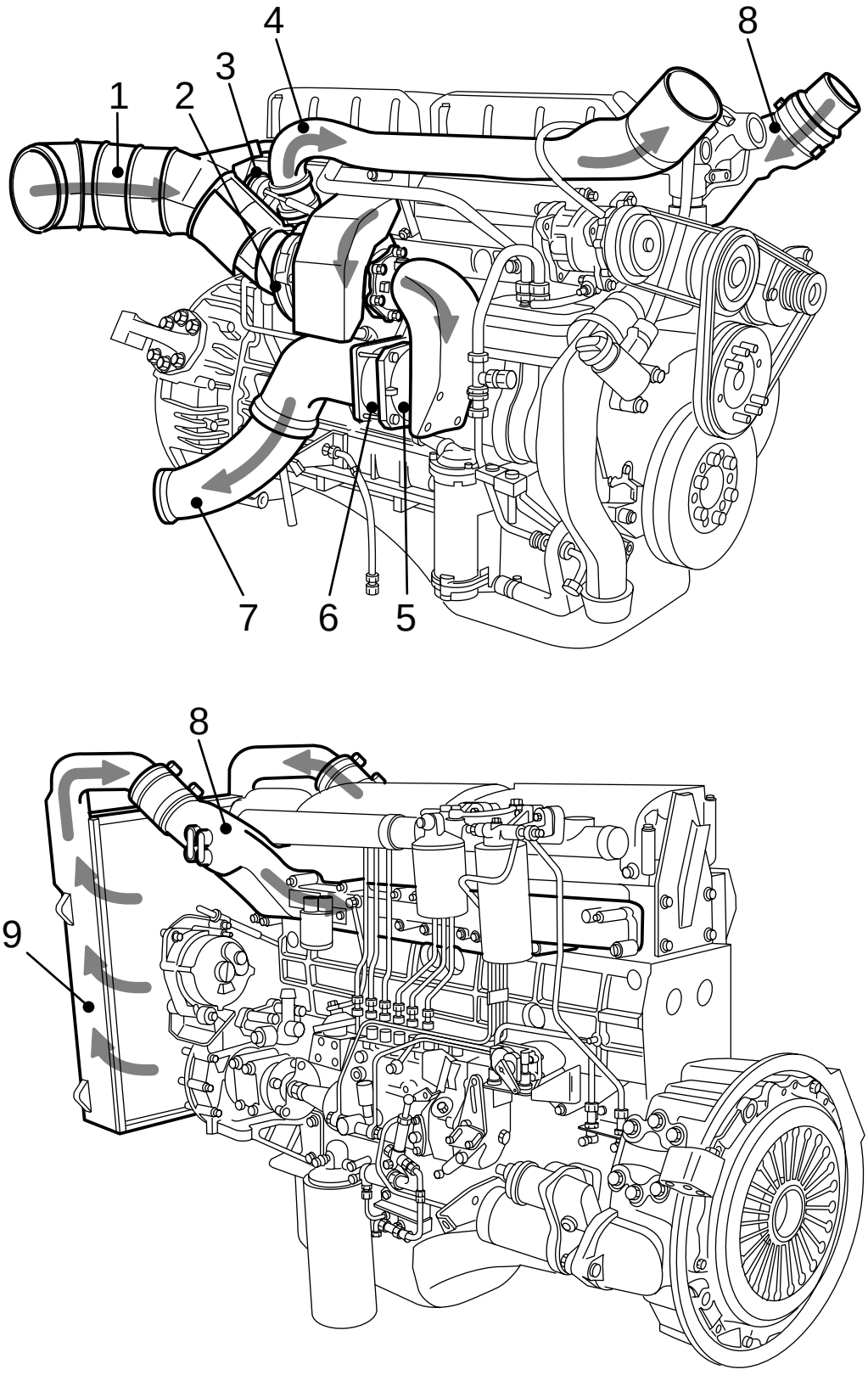
Exhaust gases contain carbon monoxide. Carbon monoxide is a deadly, colourless and odourless gas, which, when inhaled, deprives the body of oxygen, leading to asphyxiation. Serious carbon monoxide poisoning may result in brain damage or death.

It is recommended to always disconnect the battery's earth connection during repair or maintenance activities for which the power supply is not required.

3

2. GENERAL

2.1 LOCATION OF COMPONENTS



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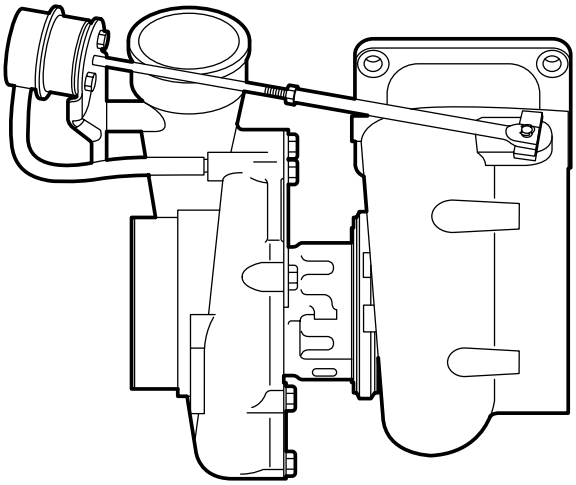
1. Inlet hose
2. Turbocharger
3. Wastegate diaphragm
4. Inlet pipe
5. Exhaust bend
6. Butterfly valve
7. Flexible exhaust pipe
8. Inlet manifold
9. Intercooler

2.2 DESCRIPTION OF TURBOCHARGER SYSTEM WITH WASTEGATE

Wastegate
To make the engine more responsive at lower engine speeds, a turbocharger is used that produces a better fill ratio at such speeds.
If no special provisions were made, the boost pressure yielded by such a turbocharger would be too high at maximum engine speeds. This is prevented by using a wastegate.
The turbocharger's compression housing has an air coupling connected with a diaphragm. The boost pressure yielded by the turbocharger operates the diaphragm and the control rod connected to it.
The control rod operates a valve in the turbine housing.
The valve in the turbine housing is opened when the maximum allowable pressure has been reached.
When the valve is opened, some of the exhaust gases will be discharged to the exhaust pipe rather than being used to propel the turbocharger's turbine wheel.



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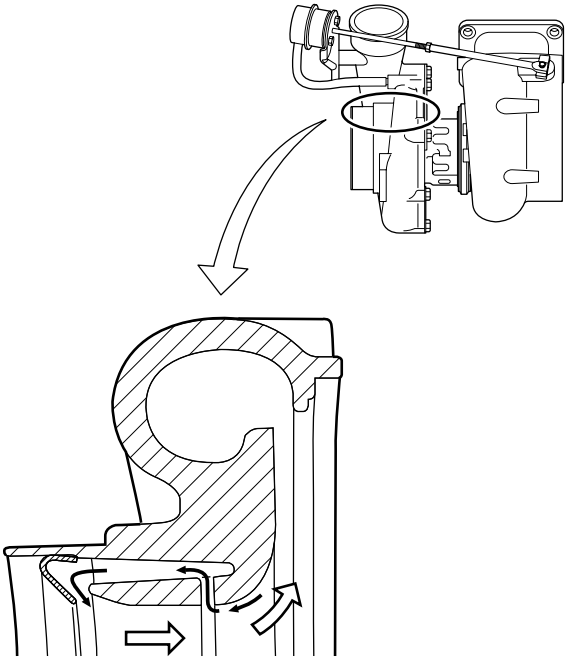
Compression housing by-pass
At higher boost pressures, the compressor of the turbocharger tends to allow this pressure to return to the inlet underpressure area. To prevent this, the compression housing of the turbocharger has been adapted.
This adaptation consists of bypass ducts and a stop plate.
Boost pressure attempting to return to the inlet area, will do so at the outer circumference of the compression housing.
Providing the compression housing with an air slot forces this pressure to flow through special air ducts on the outside until it is arrested by the stop plate.



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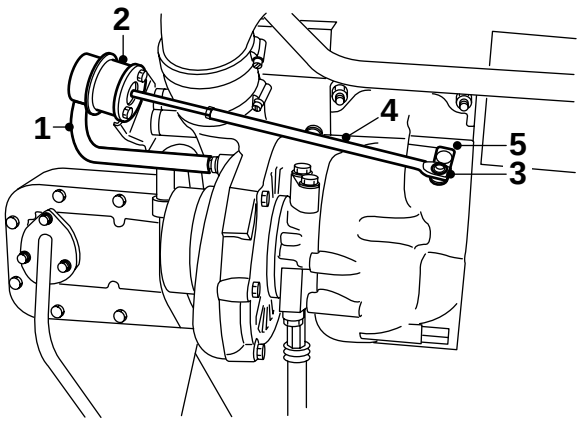
3. INSPECTION AND ADJUSTMENT

3.1 CHECKING AND ADJUSTING THE WASTEGATE TURBOCHARGER

1. Remove the heat shield from the turbocharger.
2. Remove the air supply connector (1) from the diaphragm housing (2).
3. Remove the retaining clip (3) and remove the control rod (4) from the wastegate lever.
4. Using a pressure-reducing valve, apply the required pressure setting to the diaphragm housing connection, see main group “Technical data”.
5. Push the wastegate lever fully to the left to close the wastegate valve.
6. Adjust the length of the control rod (4), making sure it fits exactly on to the lever at the set pressure.
7. Check the wastegate setting at the specified pressure, see main group “Technical data”.
8. Install the retaining clip (3).



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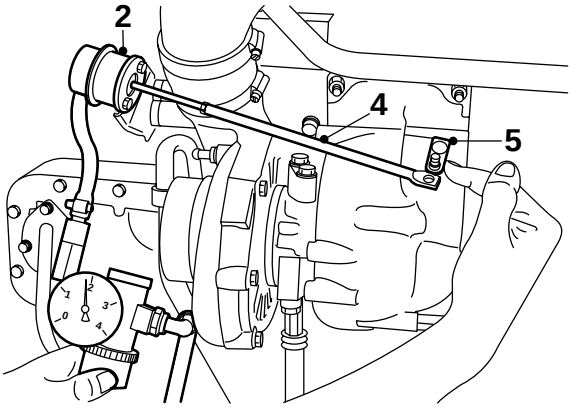


i 400214

3.2 INSPECTION OF EXHAUST BACK PRESSURE

Inspecting the exhaust back pressure

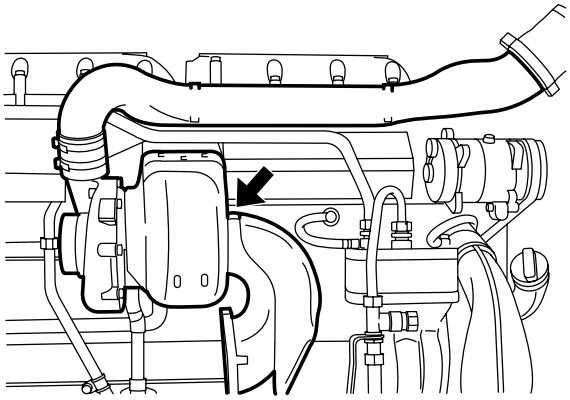
1. Remove the plug from the exhaust bend and install a suitable coupling with a pipe. The first part of the pipe must be made of metal, to withstand the high temperatures.

2. **Note:**
   Use an attenuated gauge to prevent excessive shaking of the gauge needle.

   Connect a pressure gauge to the pipe, with a range of at least 0.1 - 0.2 bar (10 - 20 kPa).

3. **Note:**
   The engine brake must not be used during measurements.
   This is done to protect the pressure gauge.

   Measure the exhaust back pressure at the maximum loaded engine speed and compare the measurement result with the specified value. See main group “Technical data”.



i 400180

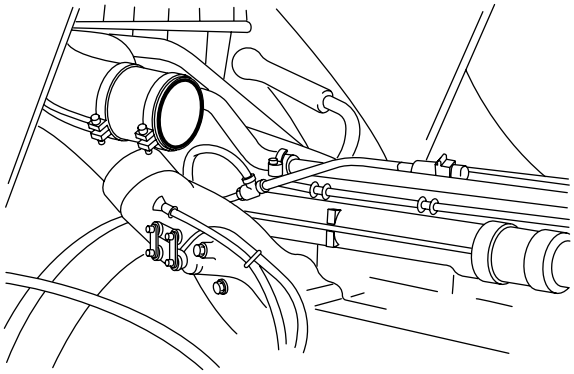
3.3 INSPECTION AND PRESSURE-TESTING OF AIR INLET SYSTEM

When pressure-testing the air-inlet system, the plugs may spring off if they are not properly secured.

In the air inlet system, check the condition and attachment of the air inlet channels/ flexible pipes.

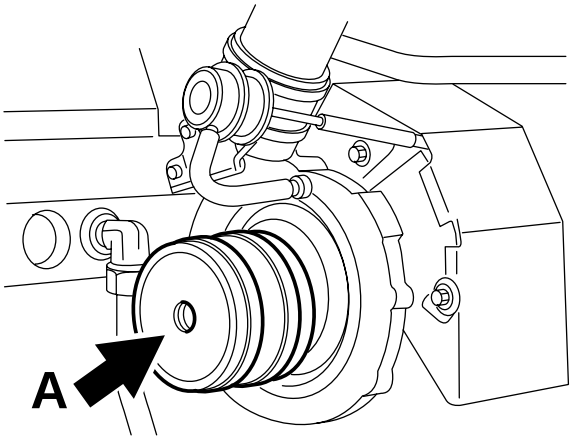
In case of doubt as to the proper sealing of the air inlet system, indicated by the following:
- loss of power
- high fuel consumption
- unusual noises,

carry out a pressure test to check the air inlet system for leaks.



i 400203

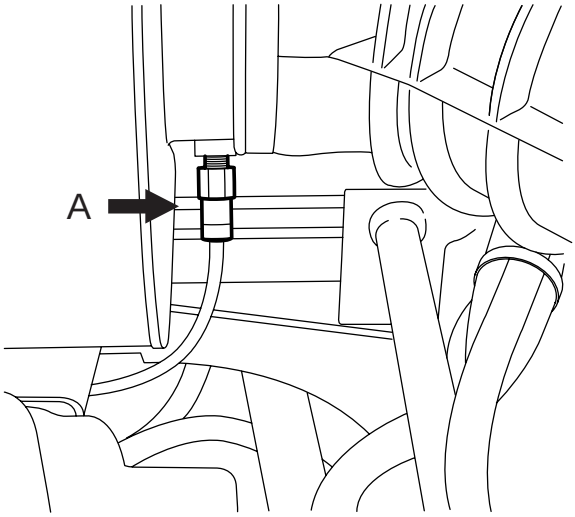
1. Remove the front engine encapsulation.
2. Remove the air inlet hose between the intercooler and the inlet manifold.
3. Install the inlet hose with the special tool (DAF no. 0694831) on the intercooler, twisting it slightly.
4. Remove the air inlet pipe between the air cleaner housing and the turbocharger intake port.
5. Install the special tools (DAF no. 1329310 and DAF no. 1329311) on the turbocharger intake port.
6. Connect an air hose with reducing valve to the plug (A), and charge the system to approx. 1 bar.
7. Use soapy water to check the complete inlet system for air leakage. Also check whether the pressure gauge of the reducer valve moves down.
8. Remove the special tool.
9. Install the air inlet pipe between the air cleaner housing and the turbocharger intake port.
10. Install the inlet hose between intercooler and inlet manifold and tighten the hose clip to the specified torque, see main group “Technical data”.



i 400204

3.4 INSPECTION OF INLET UNDERPRESSURE

1. Remove the connection of the underpressure sensor from the inlet pipe between the air cleaner housing and the turbocharger.
2. Connect a pressure gauge with a maximum rating of –100 mbar (–10 kPa) to the connection of the underpressure sensor.
3. Measure the inlet underpressure at the maximum loaded engine speed and compare the measurement result with the specified value. See main group “Technical data”.



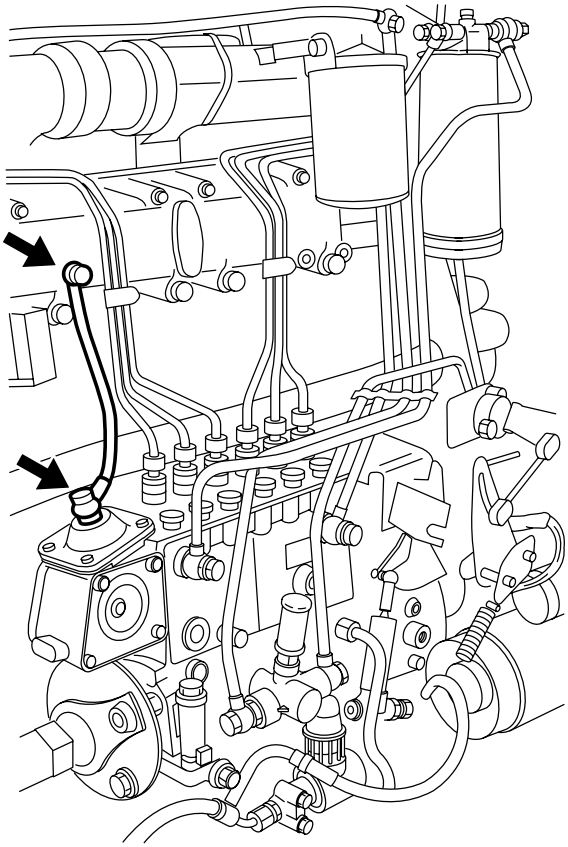
i400377

3.5 INSPECTION OF BOOST PRESSURE

To obtain a better indication of where the problem is, the injection pump gallery pressure, the inlet underpressure and the exhaust back pressure can be measured at the same time as the boost pressure.

Drive the same route each time to obtain as good a picture as possible.

Turbocharger with wastegate
When you measure the boost pressure curve of a vehicle fitted with a turbocharger with wastegate, the air hose between the compression housing and the diaphragm must **not** be disconnected.
The boost pressures measured in a vehicle fitted with a turbocharger with wastegate are reliable up to an engine speed of 1500 rpm. Above this engine speed, the wastegate cuts in and corrects the boost pressure.



i 400197

1. Use a banjo bolt (DAF no. 0664827) to connect a pressure gauge to the smoke limiter of the fuel pump, or to the inlet manifold.

   Note:
   Preferably use a pressure gauge with a range of at least 3 bar and a scale division of 0.1 bar.

2. The weight of the vehicle should approximate the maximum combination weight.

3. Run the engine at operating temperature (drive for at least 15 minutes with a loaded vehicle).

4. Select the highest gear but one.

5. In this gear, apply full throttle from 800 rpm.

6. Note, from 900 rpm, the boost pressure per 100 rpm.

7. Perform this measurement at least three times and take the mean values.

8. Plot a graph on the test sheet with the mean values found.

   Note:
   The shape of the curve is important. The exact value is of less importance.

Checking procedure following plotting of a boost pressure curve

- Check the injection timing. Adjust or optimise, if necessary.
- Check the fuel system for the presence of air.
- Replace/clean the air filter element.
- Check the setting of the wastegate on the turbocharger (if present).
- Check the exhaust brake butterfly valve for correct operation.
- Check the inlet air cooler exterior for dirt deposits.
- Visually check the low-pressure fuel pipes for leaks and correct installation.
- Clean the water separator (if fitted).
- Replace the fuel filter.
- Replace/clean the fuel prefilter (if present).
- Check the suction pipe of the tank for clogging by large pieces of foreign matter.
- Check the fuel tank for contamination. Clean the tank with a steam cleaner, if necessary.
- Check the air inlet system for any leaks.
- Check the exhaust system for any leaks.
- Check the exhaust system for blockages by measuring the exhaust back pressure.

- Check the turbocharger wheels on the compressor and turbine side for damage and for deposits of salt or any other contaminants.
- Check the banjo bolt strainer in the fuel lift pump for dirt (if fitted).
- Check the valve and DEB play.
- Check the injection lines for damage.
- Check the fuel pump gallery pressure.
- Check the discharge pump pressure.
- Check whether components of the right type have been fitted (fuel pump, turbocharger, injectors etc.)
- Check the opening pressure of the injectors.
- Clean the nozzle openings using calibrated injector needles (DAF no. 1329371).
- Remove the fuel pump from the engine.
- Check the fuel pump setting on a fuel pump test bench.

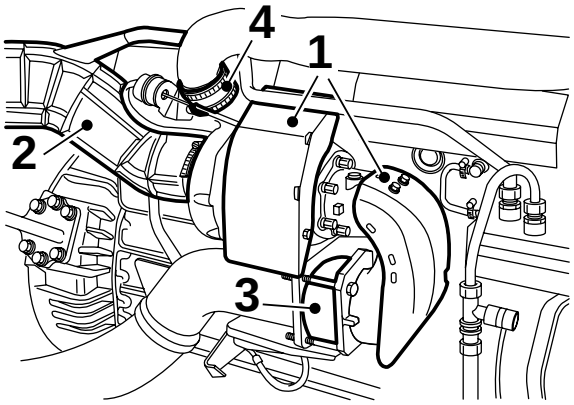
4. REMOVAL AND INSTALLATION

4.1 REMOVAL AND INSTALLATION OF TURBOCHARGER

If the turbocharger to be replaced was damaged to such an extent that parts of the turbocharger are missing or that lubricating oil has entered the inlet system, the inlet and exhaust systems must be cleaned and inspected thoroughly in order to prevent serious damage to the engine.

Removing the turbocharger

1. Remove the heat shields (1) from the turbocharger.
2. Remove the air inlet hose (2) between the turbocharger and the air filter.
3. Remove the exhaust brake (3).
4. Disconnect the connector pipe (4) from the turbocharger and the air inlet pipe to the intercooler.
5. Remove the turbocharger lubricating pipes. Plug the openings.
6. Remove the fixing nuts from the turbocharger.
7. Remove the turbocharger from the exhaust manifold.



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Installing the turbocharger

1. Before installing the turbocharger, check the following:
   - turbocharger shaft must rotate freely;
   - turbocharger shaft must not be out of true;
   - turbocharger shaft must have little radial clearance.

   If applicable:
   - movement of the wastegate.

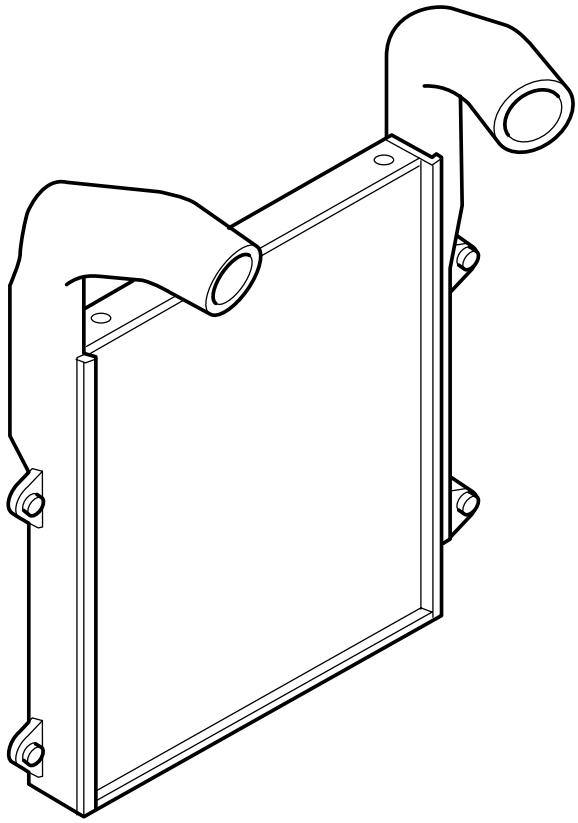
2. Clean the sealing faces.
3. Apply a layer of Copaslip to the exhaust manifold studs.
4. Always use new gaskets during installation.
5. Install the turbocharger. If necessary turning the two halves of the housing so that the oil and air pipes can be connected free of stress.
6. Install the oil discharge pipe.
7. Spray clean engine oil into the oil supply of the turbocharger, and install the oil supply pipe.
8. Install the connector pipe from the turbocharger and the air inlet pipe to the intercooler.
9. Install the exhaust brake.
10. Install the air inlet hose between the turbocharger and the air filter.
11. Install the heat shields for the turbocharger. Tighten the fixing bolts to the specified tightening torque. See main group “Technical data”.
12. **Always** check the setting of the wastegate, see chapter “Inspection and adjustment”.

4.2 REMOVAL AND INSTALLATION OF INTERCOOLER

Note:
The removal and installation procedure of the intercooler allows for the presence of an airconditioning unit.
If such a unit is not present, the sections concerned can be skipped.

Removing the intercooler

1. Remove the lower grille.
2. Remove the front engine encapsulation.
3. Remove the engine encapsulation under the cab.
4. Disconnect the two coolant pipes and the air-conditioning pipe from the pipe strip at the front of the intercooler.
5. Remove the pipe strip.
6. Remove the oil dip stick from the intercooler and put it aside.
7. Remove the radiator expansion reservoir and put it aside.
8. Remove the fixing bolts from the air-conditioning condenser and pull the condenser forwards.
9. Disconnect the other air-conditioning pipes from the intercooler.
10. Remove the wire mesh underneath the intercooler.
11. Remove the air-conditioning dryer underneath the intercooler.
12. Remove the left-hand air inlet hose from the inlet manifold to the intercooler.
13. Remove the right-hand air inlet hose from the inlet pipe to the intercooler.



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14. Remove the air-conditioning compressor unit and move it, together with the hoses, to the front of the intercooler.
15. Remove the fixing bolts from the intercooler.
16. Move the intercooler a little to the right to remove the fixing bolt of the oil filler pipe.
17. Slide the oil filler pipe to the right and put it aside.
18. Remove the reaction rod from the radiator to the engine lifting eye.
19. Carefully pull the intercooler up between the radiator and the condenser.

Installing the intercooler

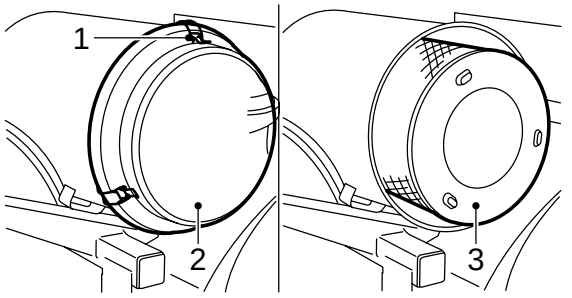
1. Carefully lower the intercooler between the radiator and the condenser.
2. Slide the oil filler pipe onto the radiator and install the fixing bolt.
3. Place the intercooler in its position and hand-tighten with two fixing bolts.
4. Install the reaction rod from the radiator to the engine lifting eye.
5. Install the air-conditioning compressor with its pipes.
6. Install the air-conditioning dryer underneath the intercooler.
7. Install the wire mesh underneath the intercooler.
8. Install the air-conditioning condenser.
9. Install the other air-conditioning pipes.

10. Install the other fixing bolts of the intercooler.
11. Insert the oil dip stick.
12. Install the pipe strip.
13. Install the two coolant pipes and the air-conditioning pipe onto the pipe strip at the front of the intercooler.
14. Install the connector pipes between manifolds and intercooler. Tighten the fixing bolts to the specified tightening torque. See main group “Technical data”.
15. Install the expansion reservoir.
16. Install the engine encapsulation under the cab.
17. Install the front engine encapsulation.
18. Install the lower grille.

4.3 REMOVAL AND INSTALLATION OF AIR CLEANER ELEMENT

Removing the air cleaner element

1. Remove the clamping bracket connectors (1) from the air-filter cover (2).
2. Remove the air-filter cover.
3. Remove the air-filter element (3).
4. Check the air cleaner element for damage. If the air-filter element or its seals are damaged, the air-filter element must be replaced.
5. Clean the inside of the air cleaner housing and the air cleaner cover.
6. If required, clean the air-filter element, see chapter “Cleaning”.



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Installing the air cleaner element

1. Install the air-filter element in the air-filter housing.
2. Install the air-filter cover, making sure the arrow on the cover points upwards.

   Note:
   This position is important if a rubber sealing valve has been installed on the air-filter cover.
3. Install the clamping brackets.

5. CLEANING

5.1 CLEANING THE RADIATOR AND INTERCOOLER

Inhalation of dust may have serious consequences for your health. Take the necessary precautions, such as wearing goggles and a face mask.

Cleaning the protective screen

1. Remove the lower grille.
2. Unscrew the protective screen attachment bolts.
3. Remove the protective screen.
4. Clean the protective screen with a hard brush, and blow-clean it with compressed air.

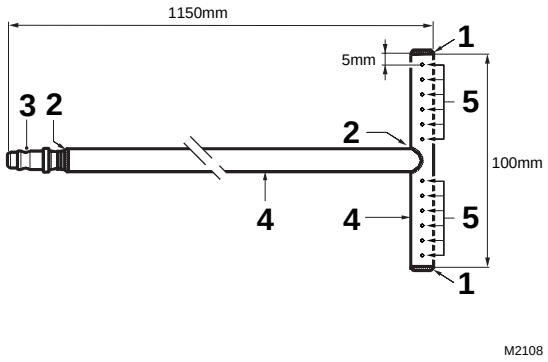
Cleaning the radiator and intercooler elements

With the aid of a simple tool, the radiator and the intercooler can be blow-cleaned.
This tool can be made in your own workshop. It cannot be obtained from DAF.

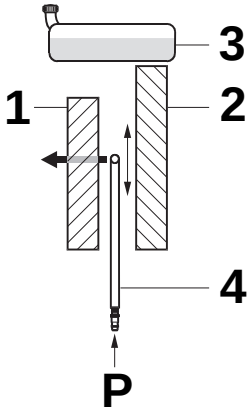
Key to drawing:

1. Solder up
2. Solder
3. Quick-release coupling for air pipe
4. Steel pipe, ∅ 10 mm
5. 6 × ∅ 1.5 mm diameter holes, with a centre-to-centre distance between the holes of 7 mm, drilled on one side.

1. Insert radiator cleaner (4) between intercooler (1) and radiator (2), from the bottom upwards, with the air holes facing the intercooler (1).



2. Apply air pressure to the radiator cleaner (4) and continue blow-cleaning the intercooler (1) until the release of dirt has stopped.



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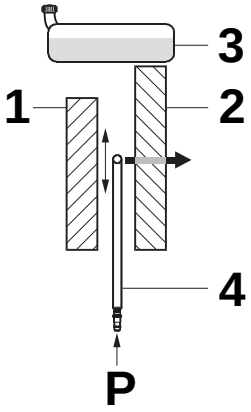
3. Turn the radiator cleaner over, turning the holes towards the radiator (2), and blow-clean the radiator (2).



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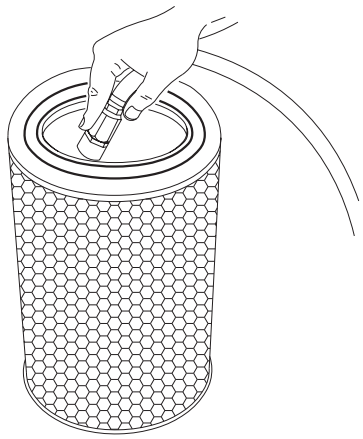
5.2 CLEANING THE AIR CLEANER ELEMENT

Inhalation of dust may have serious consequences for your health. Take the necessary precautions, such as wearing goggles and a face mask.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1. Remove the air cleaner element, see chapter “Removal and installation”.
2. Check the air cleaner element for damage. If the air-filter element or its seals are damaged, the air-filter element must be replaced.
3. Knock on the air cleaner element to remove any dirt.
4. Blow-clean the air-filter element by blowing pressurised air through from the inside, using a maximum pressure of approx. 1.5 bar.
5. Install the air cleaner element. See “Removal and installation”.

3

CONTENTS

1. SAFETY INSTRUCTIONS

Do not run the engine in an enclosed or unventilated area.
Make sure exhaust fumes are properly extracted.

Maintain a safe distance from rotating and/or moving components.

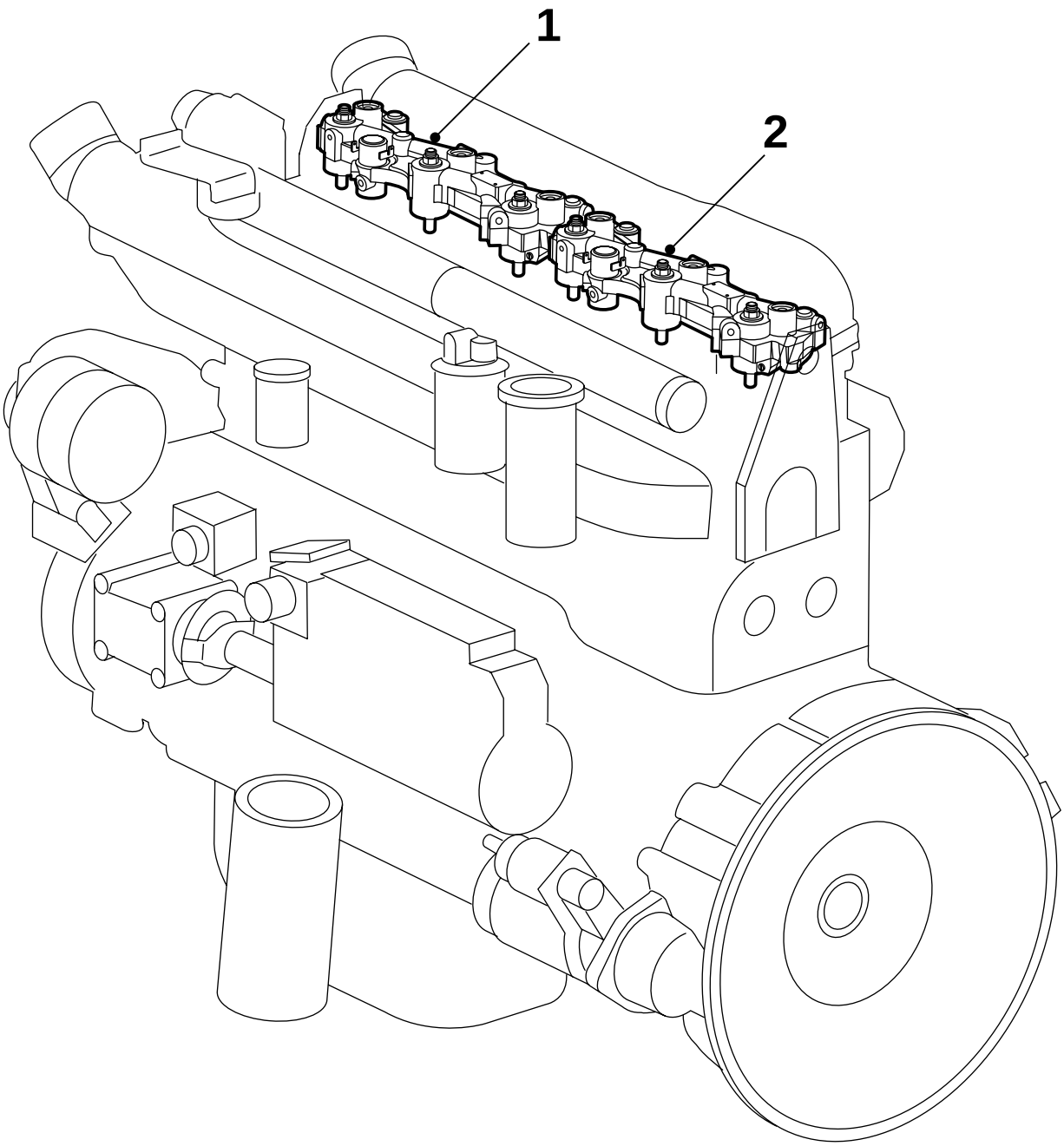
Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard. This also applies to engine coolant, windscreen washer fluid, refrigerant in air-conditioning systems, battery acid and diesel fuel.
So avoid inhaling and direct contact.

Exhaust gases contain carbon monoxide. Carbon monoxide is a deadly, colourless and odourless gas, which, when inhaled, deprives the body of oxygen, leading to asphyxiation. Serious carbon monoxide poisoning may result in brain damage or death.

It is recommended to always disconnect the battery's earth connection during repair or maintenance activities for which the power supply is not required.

2. GENERAL

2.1 LOCATION OF DEB COMPONENTS



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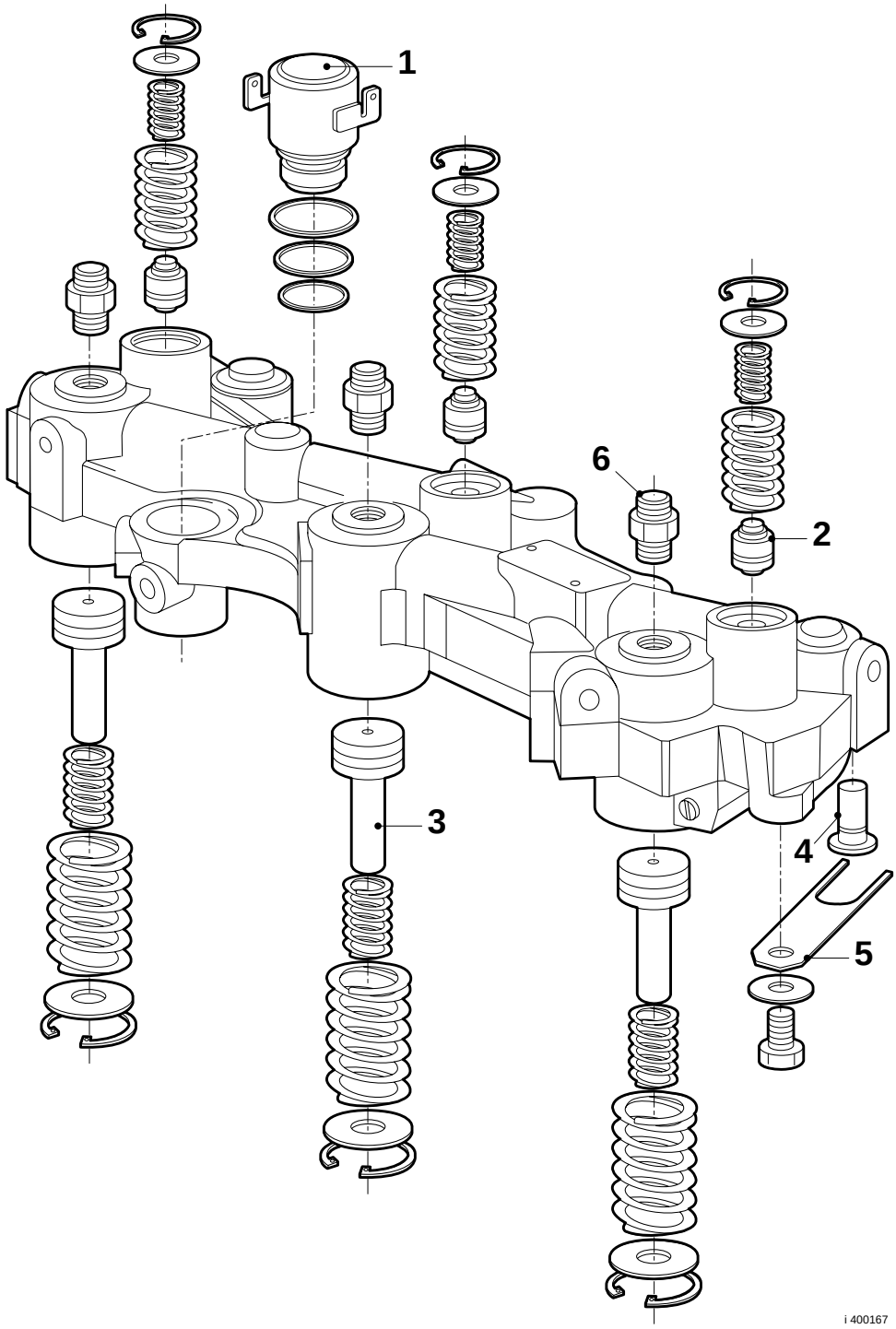
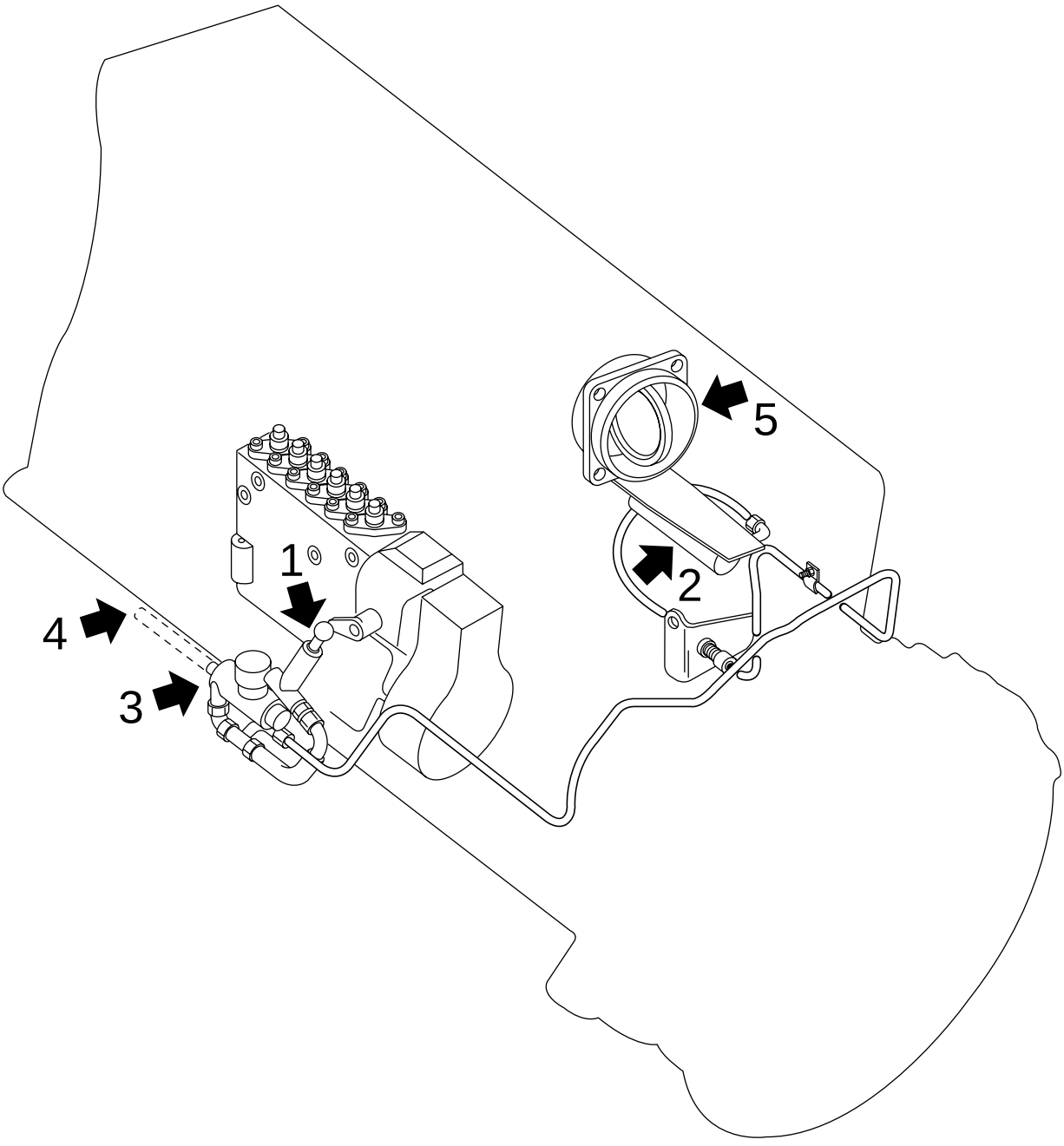
1. DEB housing, cylinders 1 - 2 - 3
2. DEB housing, cylinders 4 - 5 - 6

2.2 OVERVIEW DRAWING DEB



1. Magnetic valve
2. Control valve
3. Operating piston
4. Main piston
5. Spring plate
6. Set screw

2.3 LOCATION OF EXHAUST BRAKE COMPONENTS



i 400185

1. Engine stop operating cylinder
2. Butterfly valve operating cylinder
3. Engine stop valve
4. Supply pressure
5. Butterfly valve housing

2.4 GENERAL DESCRIPTION OF ENGINE BRAKE SYSTEM

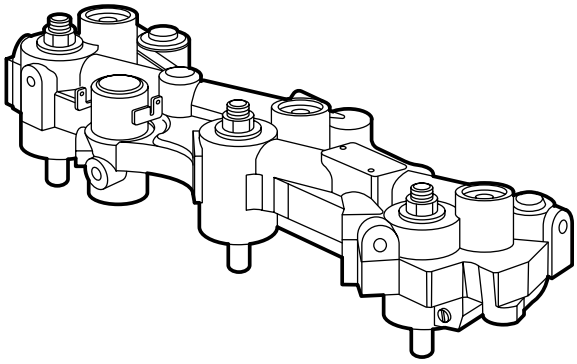
The collective term “engine brake” covers the exhaust brake or butterfly valve, and the DAF Engine Brake.

The introduction of the DAF XF 12.6 litre engine also marks the introduction of a new type of engine brake for DAF.
This is the DAF Engine Brake, or DEB for short.

Every XF engine has a factory-fitted exhaust brake.
At customer’s request, the DEB can be installed at the factory or at a later date.

If the driver activates the engine brake by means of the engine brake control switch on the cab floor, both the exhaust brake and the DEB are engaged. Therefore, the DEB always works in conjunction with the exhaust brake.

As the CTE-2 checks the activation of the engine brake, it will disengage the engine brake below a certain engine speed (see CTE-2 systems manual).



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2.5 DESCRIPTION OF DEB SYSTEM

The DEB consists of two different housings, each cylinder head having its own DEB housing. Each housing contains various valves, pistons, and a magnetic valve.

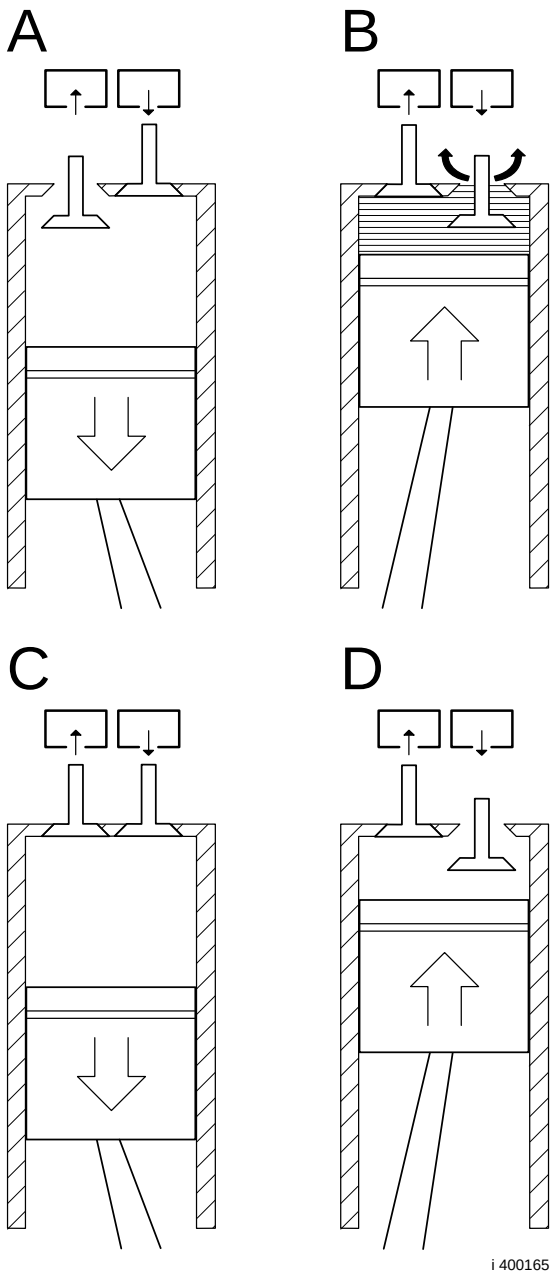
When the DEB is activated, one exhaust valve will be opened hydraulically at the end of the compression stroke. This allows compressed air to escape to the exhaust system.
The engine now functions as a compressor, supplying brake power to the vehicle.

Position (A) Induction stroke
The piston moves down and the cylinder is filled with clean air.

Position (B) Compression stroke
The piston moves up and compresses the air in the cylinder, creating a reactionary force.
At the end of this stroke, one exhaust valve is opened briefly. The compressed air can now escape to the exhaust system.
If the DEB has been activated, no fuel is injected at the end of the compression stroke and hence no combustion takes place.

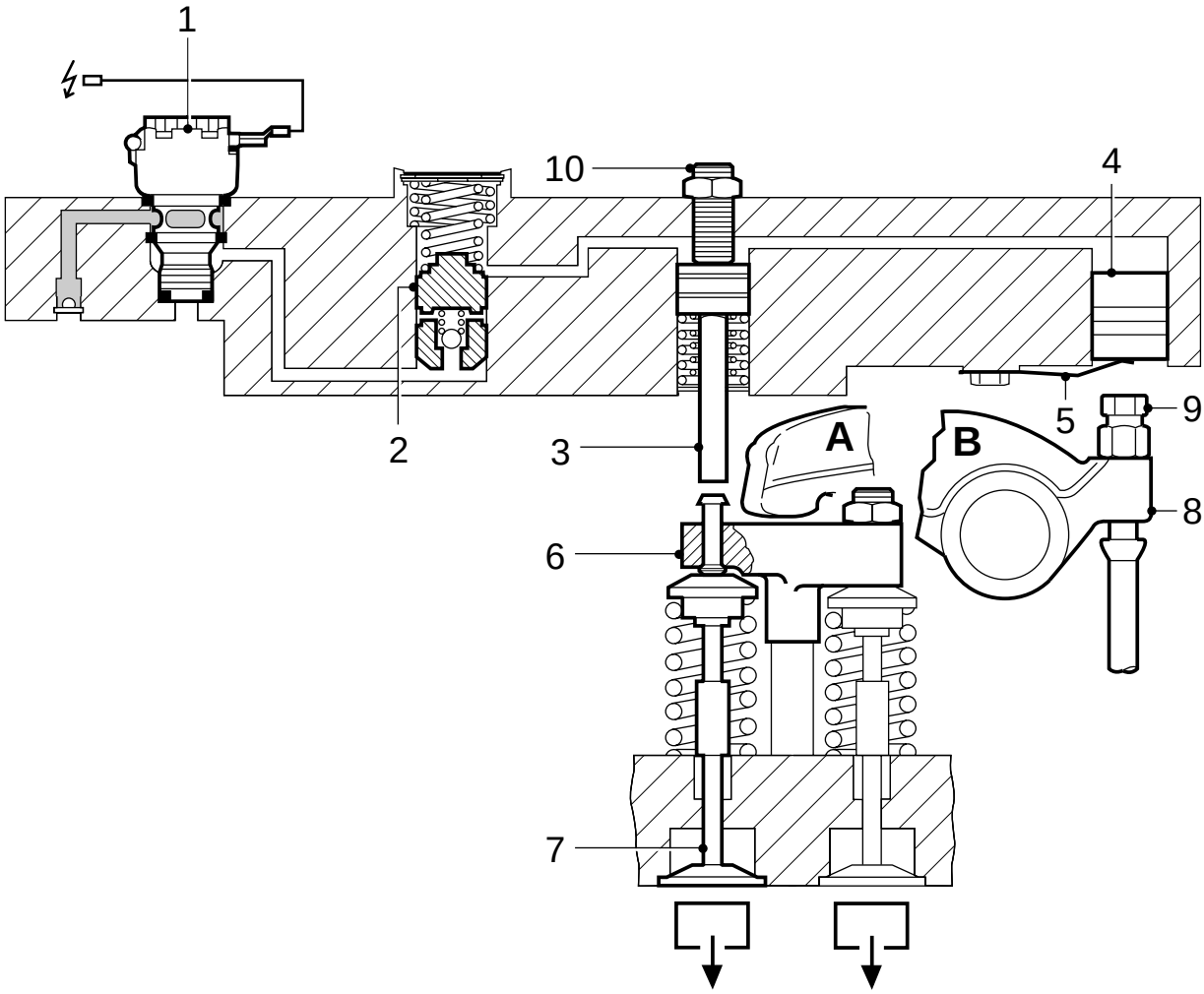
Position (C) Power stroke
The piston moves down and the exhaust valve closes.

Position (D) Exhaust stroke
The piston moves up, as during a normal exhaust stroke.



Operation of the hydraulic DEB

DEB switched off

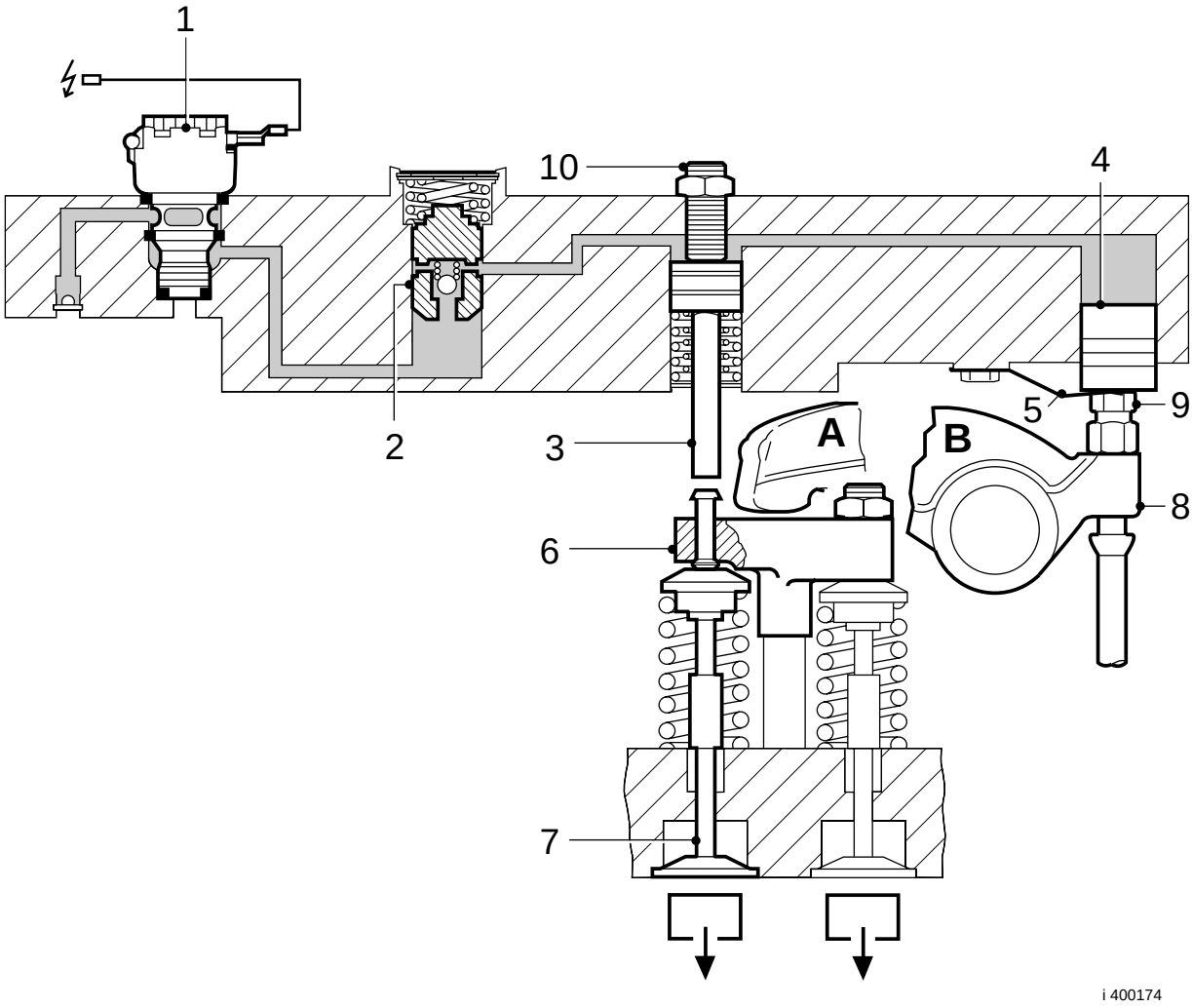


1. Magnetic valve
2. Control valve
3. Operating piston
4. Main piston
5. Spring plate
6. Bridge
7. Exhaust valve
8. Exhaust valve rocker
9. Valve clearance set screw
10. DEB set screw

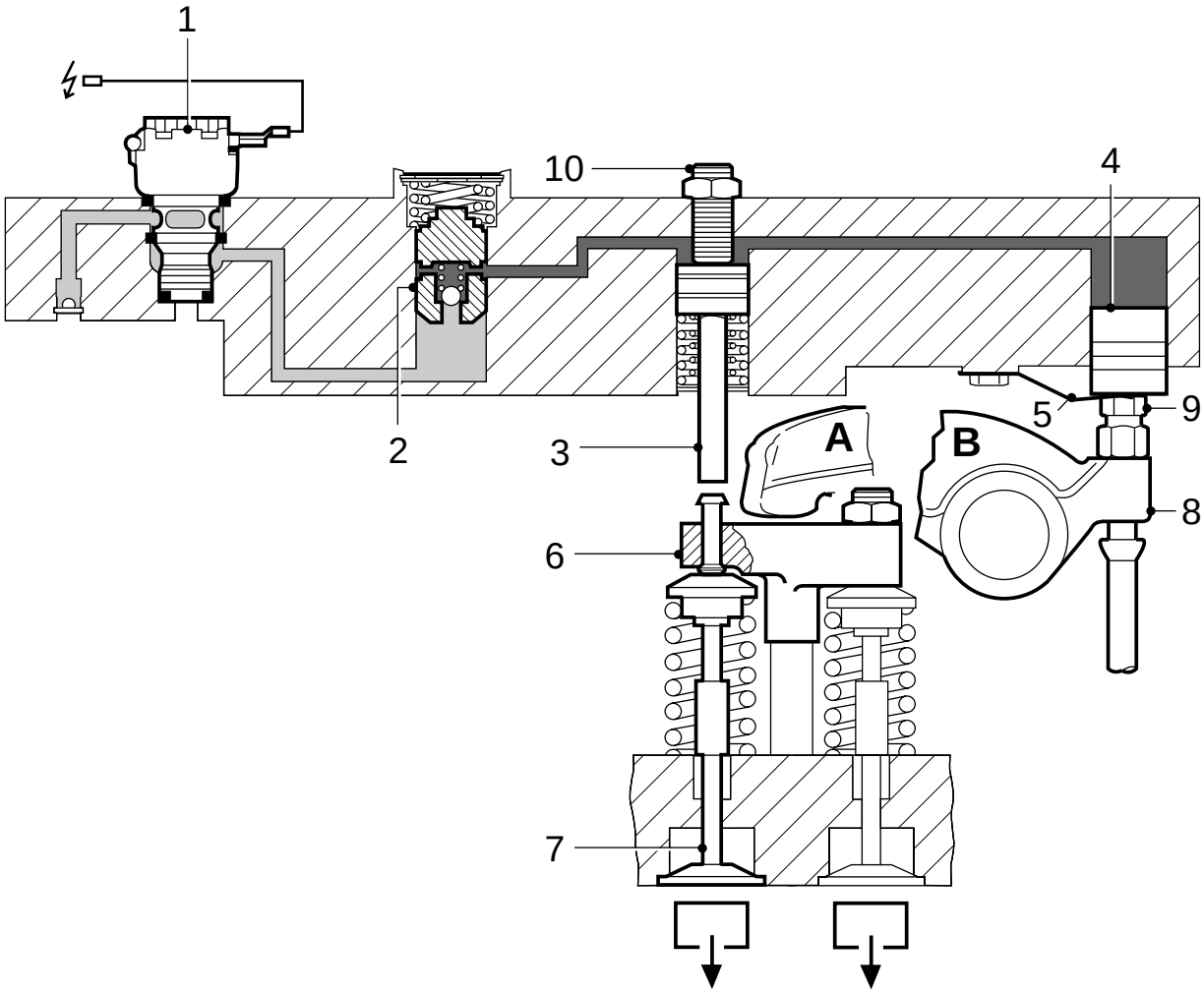
Note:
Rockers A and B are not one and the same rocker (see “Hydraulic control of exhaust valves”).
A. Exhaust valve rocker
B. Exhaust valve rocker

The magnetic valve (1) is not activated.
Lubricating oil cannot pass to the hydraulic section of the DEB.
In addition, a spring plate (5) ensures that the main piston (4) remains in the top position.

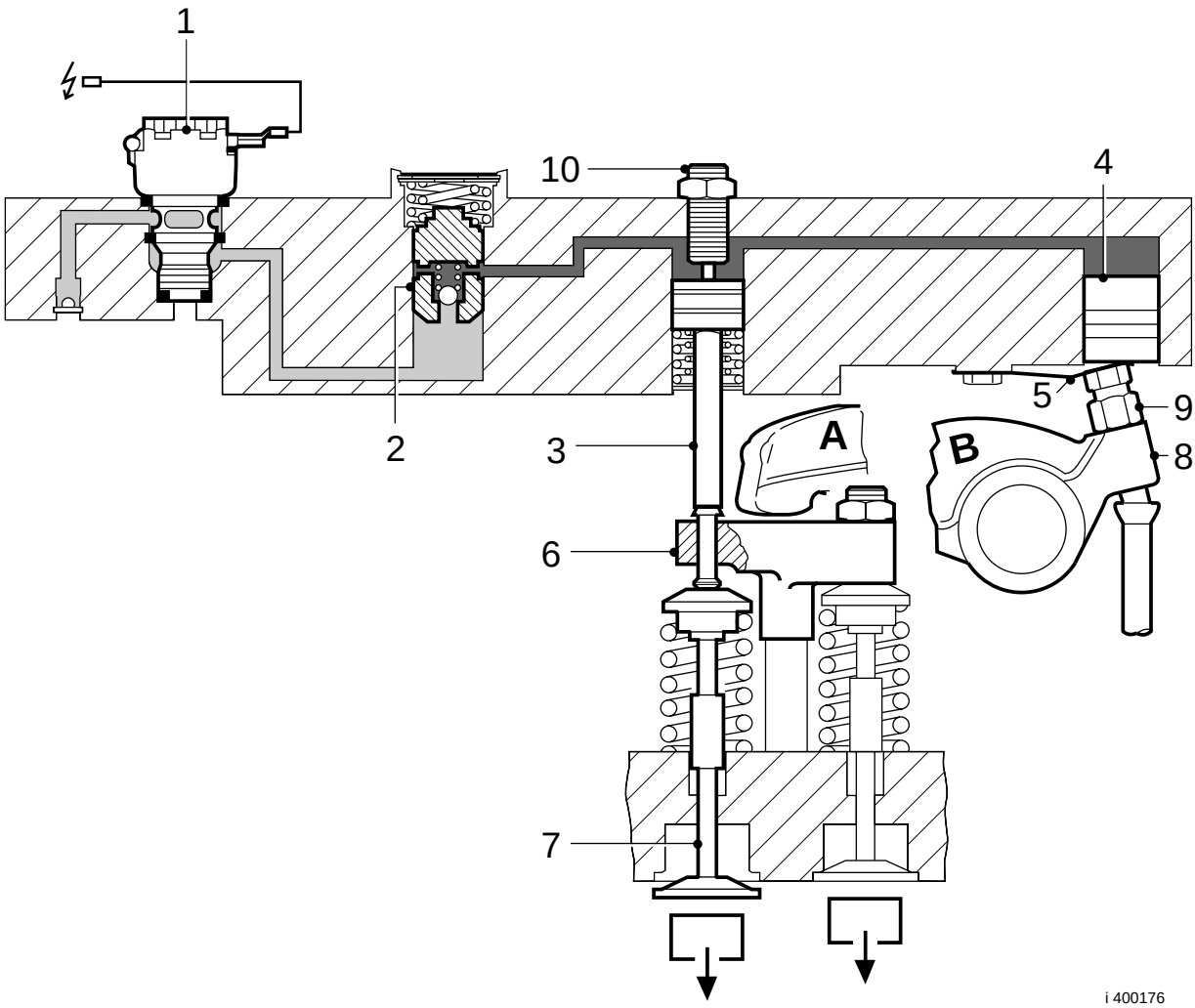
DEB switched on



The magnetic valve (1) is activated. Lubricating oil can pass to the hydraulic section of the DEB. The pressure of the lubricating oil, at least 1.5 bar, moves the control valve (2) against the spring pressure and lifts the ball from its seat. The high-pressure area of the DEB is now filled with lubricating oil.
The oil causes the main piston (4) to move down, until it rests on the set screw (9) of the rocker (8).

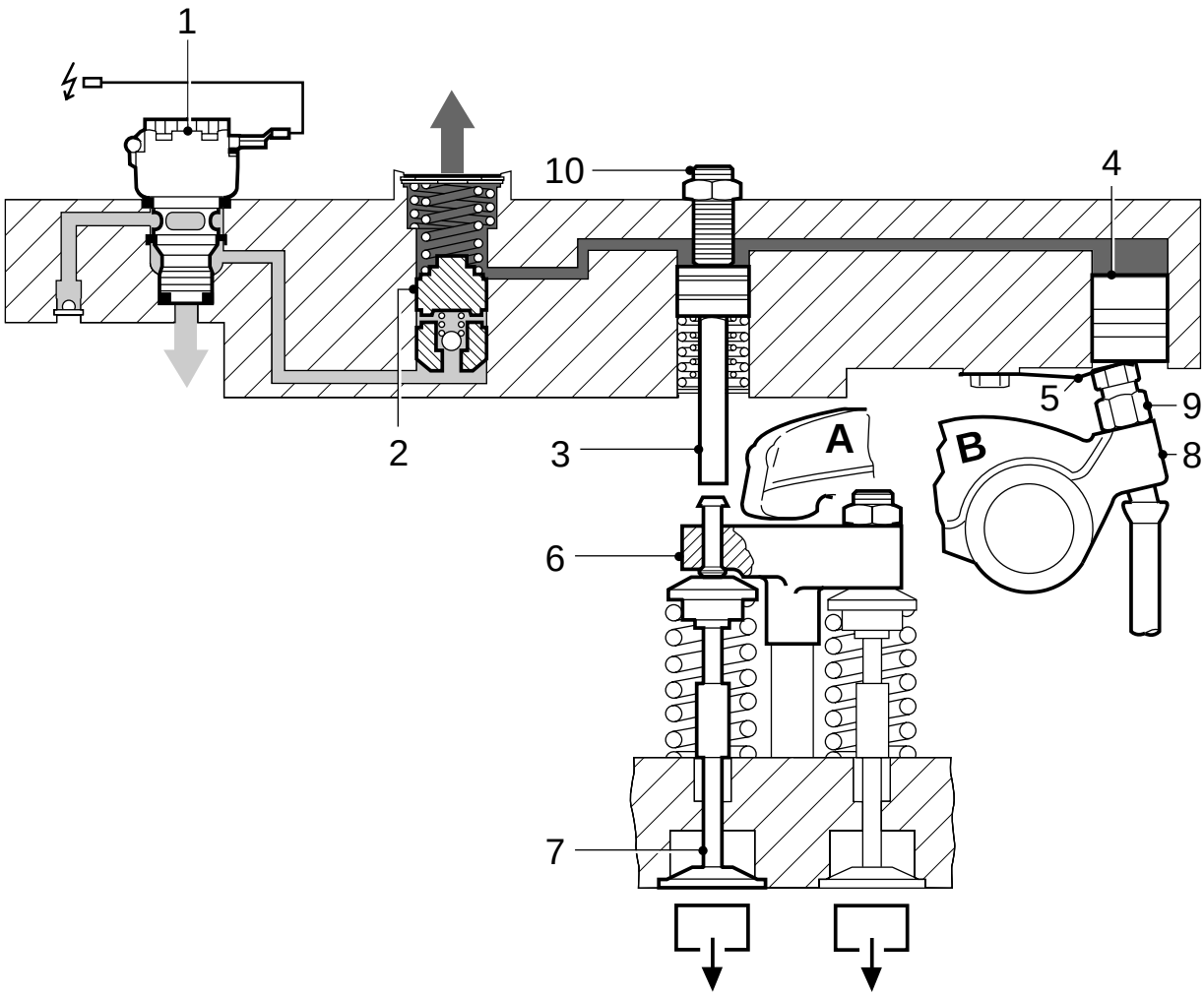


During the next upward movement of the rocker (8), the main piston (4) will be moved upwards. The main piston (4) begins to build up pressure, causing the ball in the control valve (2) to close off the oil supply.



When the main piston (4) continues to move up, this movement is transferred hydraulically to the operating piston (3).
The operating piston (3) moves downwards against the spring pressure, opening one exhaust valve.
In the case of loss of oil during operation, this will automatically be compensated for by the control valve (2).

Switching off the DEB



The magnetic valve (1) is no longer activated.
The spring pressure moves the control valve (2) downwards, as the oil pressure under the control valve (2) can flow back into the engine through a hole in the magnetic valve (1).
The oil from the high-pressure area of the DEB can now escape through a cleared opening above the control valve (2).
This is effected by the main piston (4) being moved up by the rocker.
The spring plate (5) holds the main piston (4) in its top position.

Hydraulic control of the exhaust valves
To open an exhaust valve hydraulically at the end of a compression stroke, optimal use is made of the valve diagram.
This means that the DEB uses an exhaust valve rocker of one cylinder to open an exhaust valve for another cylinder.

Cylinders 1, 2 and 3
Exhaust valve rocker of cylinder 1 hydraulically opens the exhaust valve of cylinder 3

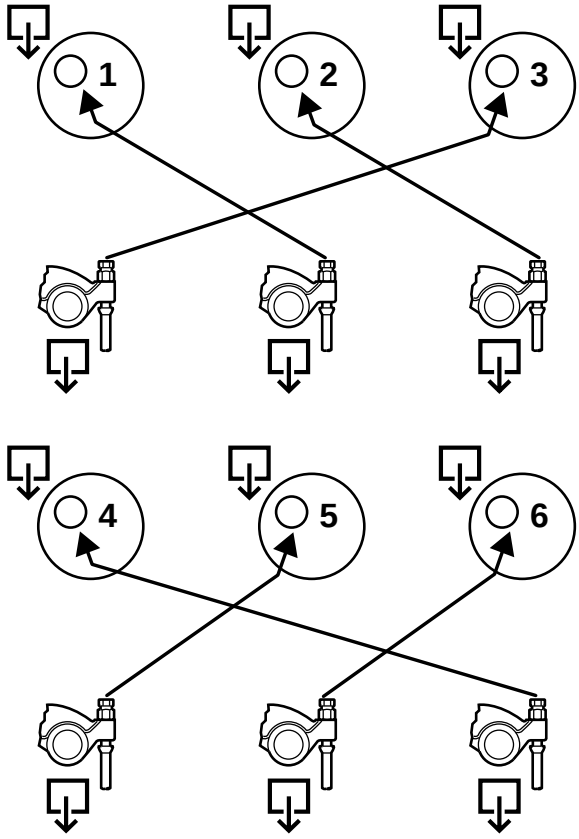
Exhaust valve rocker of cylinder 2 hydraulically opens the exhaust valve of cylinder 1

Exhaust valve rocker of cylinder 3 hydraulically opens the exhaust valve of cylinder 2

Cylinders 4, 5 and 6
Exhaust valve rocker of cylinder 4 hydraulically opens the exhaust valve of cylinder 5

Exhaust valve rocker of cylinder 5 hydraulically opens the exhaust valve of cylinder 6

Exhaust valve rocker of cylinder 6 hydraulically opens the exhaust valve of cylinder 4



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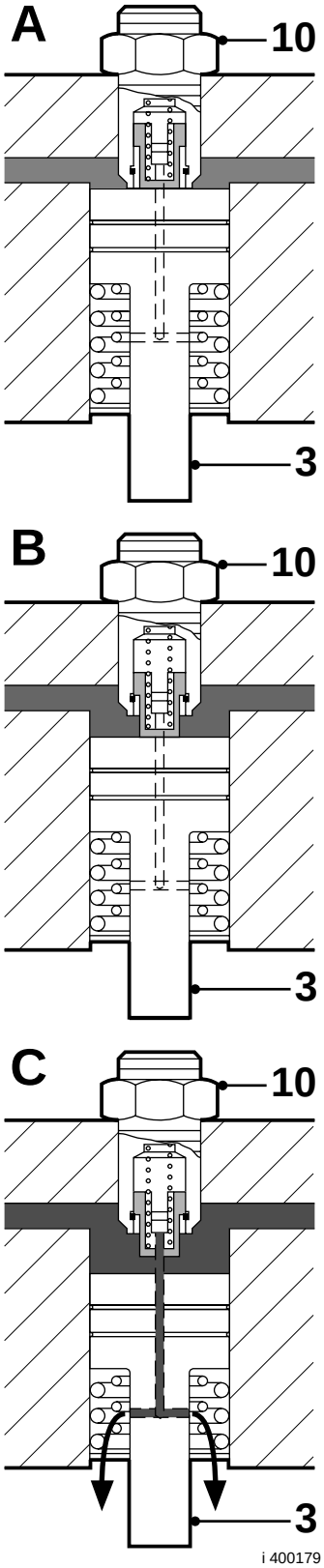
Preventing the exhaust valve from opening too far
Inside the set screw (10) is a spring-loaded pin. This pin projects approx. 2.7 mm from the set screw (10).
The operating piston (3) has a hole which is closed by the pin in the set screw (10).
If the operating piston (3) is hydraulically moved too far down, the hole in the operating piston (3) will no longer be closed. Oil in the high-pressure area escapes via the hole in the operating piston (3), preventing the exhaust valve from opening any further.

Position A:
Operating piston inactive.

Position B:
Operating piston during regular operation.

Position C:
Operating piston hydraulically opened too far, oil pressure is discharged via the operating piston.



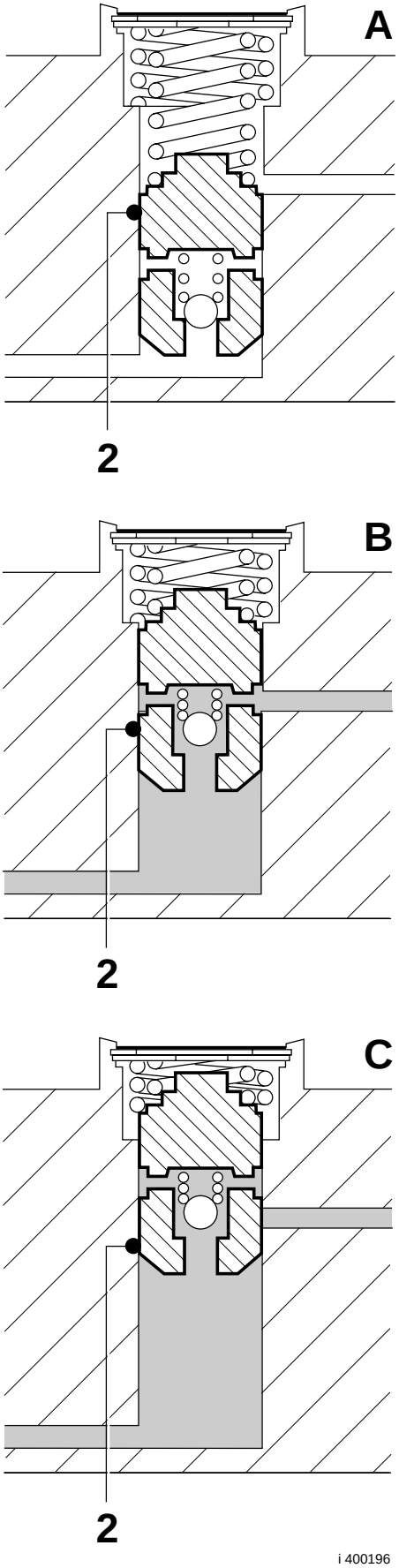
Protection against excess lubricating-oil pressure
There are 2 springs above the control valve.
When the DEB is switched on, the control valve will be moved upwards by the engine oil pressure against the direction of the pressure of the inner spring.
This clears the way for the lubricating oil to pass to the high-pressure area of the DEB.
If the lubricating-oil pressure in the engine is too high (≥ 8 bar), the control valve will be moved upwards against the pressure of both springs.
The control valve will move up further than usual, preventing the route to the high-pressure area of the DEB from being cleared.
The DEB will not function in this case.

Note:
A pressure in excess of 8 bar may result from:
- cold lubricating oil
- defective lubricating-oil pressure-relief valve

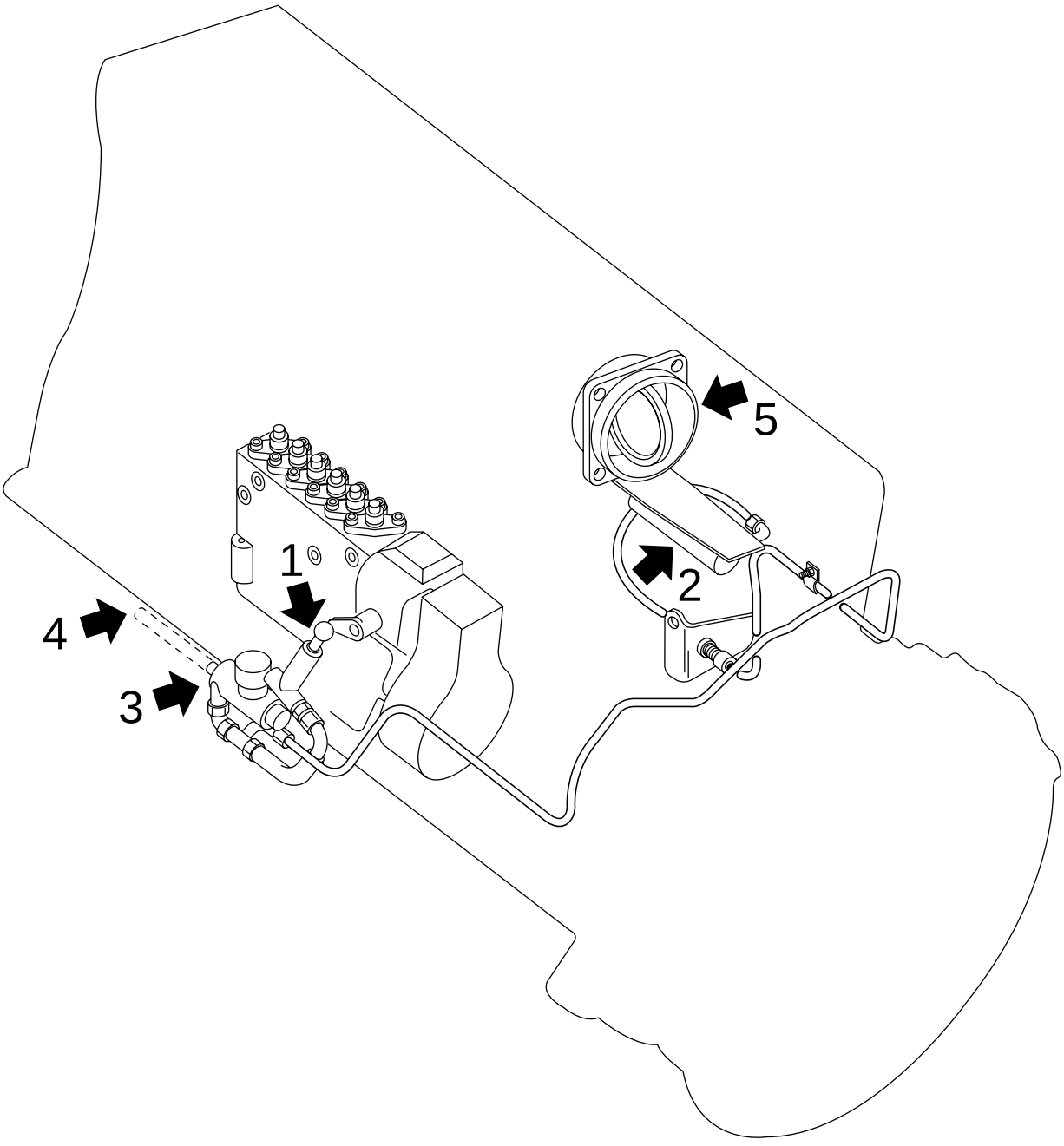
Position A:
DEB switched off

Position B:
DEB switched on
Lubricating-oil pressure between 1.5 and 8 bar

Position C:
DEB switched on
Lubricating-oil pressure ≥ 8 bar



2.6 DESCRIPTION OF EXHAUST BRAKE SYSTEM



1. Engine stop operating cylinder
2. Butterfly valve operating cylinder
3. Engine stop valve
4. Supply pressure
5. Butterfly valve housing

Switching on the exhaust brake
The exhaust brake consists of an engine brake control switch fitted in the cab floor, an engine stop valve (3), an operating cylinder (1) connected to the fuel pump stop lever, and an operating cylinder (2) connected to the butterfly valve in the exhaust pipe.
If the engine brake control switch is operated, a signal is passed to the CTE unit. This signal activates the engine stop valve (3), causing compressed air to flow to the operating cylinder (1).
This operating cylinder (1) places the fuel pump in the stop position.
At the same time, compressed air flows to the operating cylinder (2). The latter cylinder closes the butterfly valve in the butterfly valve housing. The exhaust pipe is then almost entirely closed off.
Controlled discharge of exhaust gases is still possible through a calibrated hole in the butterfly valve.
The engine now acts as a compressor, creating a braking action.
The higher the engine speed, the greater the braking action of the exhaust brake.

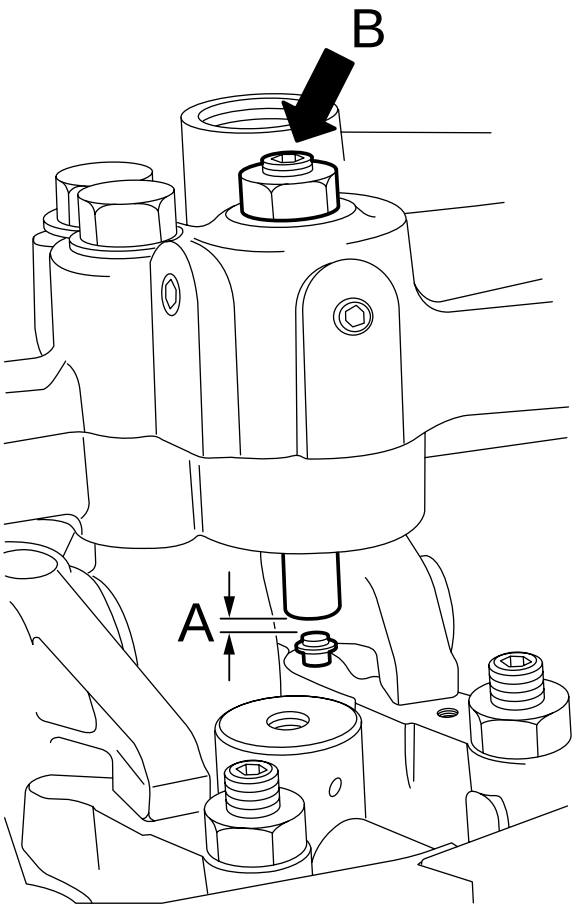
Switching off the exhaust brake
If the engine brake control switch is released, the engine stop valve will bleed the two cylinders. The springs fitted in the cylinders force the pistons back into in their starting position, thus re-opening the butterfly valve, and the fuel pump starts to deliver once again.

3. INSPECTION AND ADJUSTMENT

3.1 INSPECTION AND ADJUSTMENT, DEB PLAY

When the engine is or parts thereof are opened, it is possible for dirt to penetrate which can result in serious damage to the engine. You should therefore clean the engine before opening it.

1. Remove the valve covers.
2. Tighten the DEB fixing bolts to the specified torque, see main group “Technical data”.
3. Use special tool (DAF no. 1310477) to crank the engine in the direction of rotation until cylinder 1 has reached the top dead centre (TDC) and the valves of cylinder 6 rock.
4. Use set screw (B) to set the DEB play (A) of cylinders 1, 3 and 5, see main group “Technical data”.
   Then tighten set screw (B) to the specified tightening torque, see main group “Technical data”.
5. Use special tool (DAF no. 1310477) to crank the engine in the direction of rotation until cylinder 6 has reached the top dead centre (TDC) and the valves of cylinder 1 rock.
6. Use set screw (B) to set the DEB play (A) of cylinders 2, 4 and 6, see main group “Technical data”.
   Then tighten set screw (B) to the specified tightening torque, see main group “Technical data”.
7. Fit the valve covers.



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3.2 FUNCTIONAL CHECK OF DEB

Electrical DEB check

1. Disconnect both DEB connectors at the valve cover.
2. Check the magnetic valve for an open circuit and for the correct resistance value using a multimeter (set to the resistance value position), see main group “Technical data”.
3. Check whether the magnetic valve is short-circuited to the vehicle’s earth.
4. Connect a multimeter (set to the volt measuring position) to the connector of the engine wiring harness.
5. Start the engine and, using the throttle, increase the engine speed to approx. 1500 rpm.
6. Activate the engine brake by means of the engine brake control switch on the cab floor. The multimeter should display a reading, see main group “Technical data”.

   Note:
   As the CTE checks the activation of the engine brake, it will disengage the engine brake below a certain engine speed (see CTE systems manual).

Mechanical DEB check

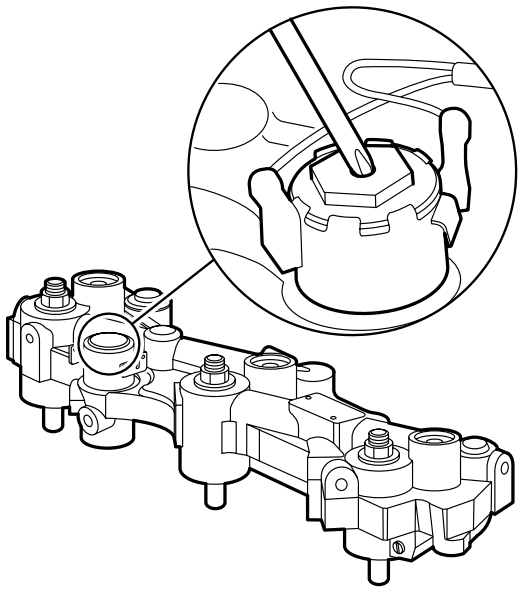
When the engine is run without the valve covers, hot lubricating oil may escape from the engine. Make sure you are adequately protected.

When the engine is or parts thereof are opened, it is possible for dirt to penetrate which can result in serious damage to the engine. You should therefore clean the engine before opening it.

Note:
If the DEB has been removed, you must first switch the DEB on and off several times with the engine running. This is done to bleed the DEB and fill it with lubricating oil.

1. Remove the valve covers.
2. Start the engine, and run it at idling speed.
3. **Note:**
   When the DEB is mechanically activated, the fuel pump is **not** switched into the stop position and continues to inject fuel. Each DEB should therefore be activated for as brief a period of time as possible.

   Use a small screw driver to push the pin in the centre of the magnetic valve downwards. The DEB has now been activated mechanically.
4. Visually check whether the main and operating pistons of the DEB move and/or the exhaust valve is opened.
5. When you switch off the DEB, check whether lubricating oil is discharged from the control valves.
6. Fit the valve covers.



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3.3 INSPECTION AND ADJUSTMENT OF ENGINE STOP/EXHAUST BRAKE

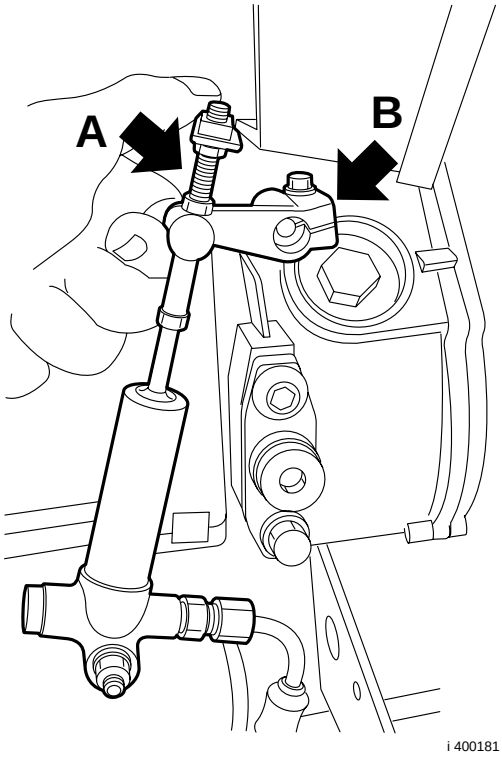
Inspecting the engine stop/exhaust brake

1. Switch on the vehicle contact.
2. **Note:**
   After deactivation of the vehicle contact, the operating cylinders will be activated for a certain time (for duration see CTE systems manual).

   Switch off the vehicle contact and visually check whether the operating cylinders of the stop control and the butterfly valve are being operated.

Setting the engine stop

1. Release the lock nut of the stop bolt (A) and turn in the stop bolt several turns.
2. Move the stop lever (B) to the stop position until it makes contact internally in the regulator housing.
3. Turn the stop bolt (A) out again until it makes contact with the stop lever (B) ball head.
4. Turn the stop bolt (A) out another 1 mm, or 2 full turns, and fasten the counter nut.



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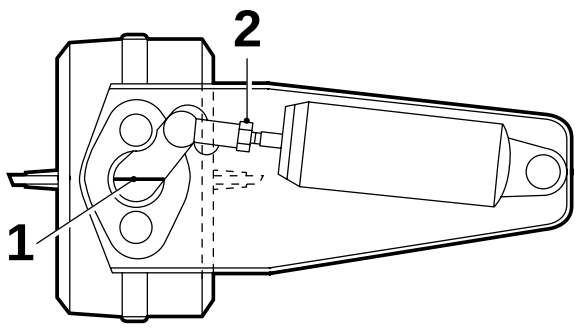
Adjusting the exhaust brake

1. Release the ball head of the butterfly valve control lever.
2. Open the butterfly valve fully (engine brake inactive), indicated by the mark (1) on the butterfly valve shaft.
3. Set the length of the piston rod (2) making sure that without air pressure, a pre-stress is present of 1 to 2 mm.
4. Use air pressure to check the exhaust brake for smooth operation.



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4. REMOVAL AND INSTALLATION

4.1 REMOVAL AND INSTALLATION OF DEB

**Make sure that the spring plate (5) under the main piston (4) is not damaged or deformed.
When the DEB is in operation, this spring plate, if it is damaged or disformed, can break off and result in serious damage to the engine.**

When the engine is or parts thereof are opened, it is possible for dirt to penetrate which can result in serious damage to the engine. You should therefore clean the engine before opening it.

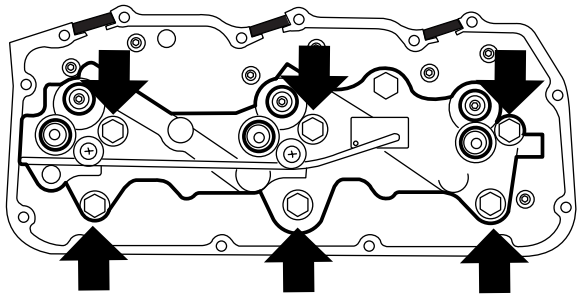
Removing the DEB

1. Remove the valve covers.
2. Disconnect the electrical connections and remove the wiring harness from its housing.
3. Remove the DEB fixing bolts and the entire DEB.

Installing the DEB

1. Tighten the rocker bracket fixing bolts to the specified torque, see main group “Technical data”.
2. **Note:**
   Note that there are two different DEB housings for cylinders 1 to 3, and cylinders 4 to 6, indicated on the DEB housing.

   Place the DEB on the rocker brackets
3. Insert the DEB fixing bolts and tighten them to the specified tightening torque, see main group “Technical data”.
4. Attach the electrical connections.
5. Adjust the valve clearance.
6. Set the DEB clearance, see chapter “Inspection and adjustment”.
7. Fit the valve covers.



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4.2 REMOVAL AND INSTALLATION OF DEB SPRING PLATE

Removing the DEB spring plate

1. Remove the DEB.
2. Remove the spring plate (5) with shim and fixing bolt.

Installing the DEB spring plate

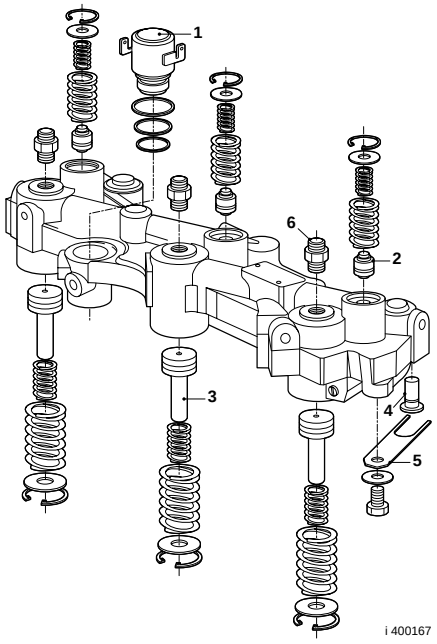
1. **Note:**
   To prevent the spring plate from being damaged or broken, it should be positioned very carefully.

   Use the special tool (DAF no. 1329321) to position the spring plate (5) onto the main piston (4).

2. **Note:**
   To prevent the spring from breaking, the lock washer should be positioned against the spring plate with its rounded edge. As from mid-1997, the vehicles are equipped with a lock washer with two rounded edges.

   Install the washer with fixing bolt and tighten it to the specified tightening torque, see main group “Technical data”.

3. Install the DEB.



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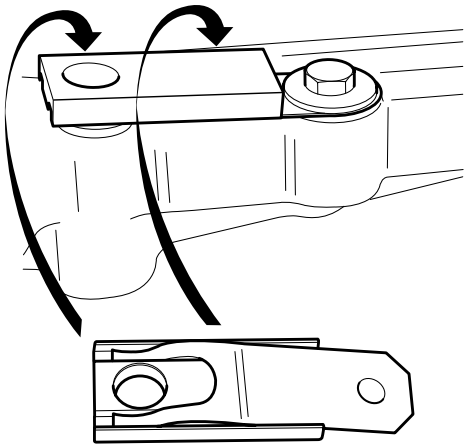
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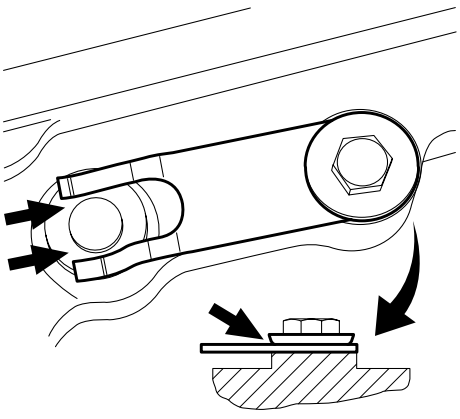
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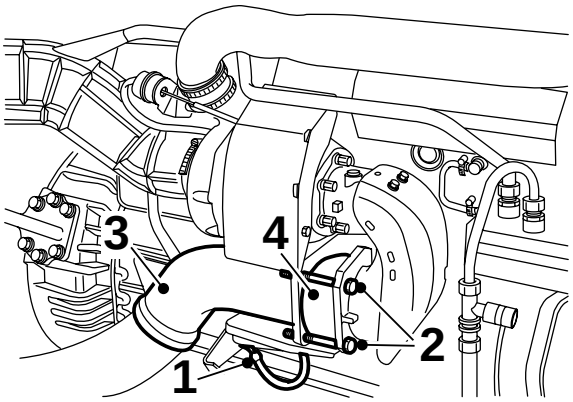
4.3 REMOVAL AND INSTALLATION OF EXHAUST BRAKE



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Removing the exhaust brake

1. Disconnect the air supply connector (1) from the operating cylinder.
2. Remove the four fixing bolts (2) holding the butterfly valve housing between the exhaust pipes.
3. Remove the flexible exhaust pipe (3).
4. Remove the entire exhaust brake (4).

Installing the exhaust brake

1. Check the butterfly valve for smooth operation.
2. Check the sealing faces of the butterfly valve housing and the exhaust pipes.
3. Clean the fixing bolts and apply heat-resistant grease to the threads.
4. Install the four fixing bolts and the exhaust brake.
5. Install the flexible exhaust pipe.
6. Tighten the fixing bolts evenly.
7. Check the setting of the exhaust brake. See “Inspection and adjustment”.

CONTENTS

5

1. SAFETY INSTRUCTIONS

Diesel fuel is an extremely flammable liquid, and may not be exposed to open flames or brought into contact with hot parts. The diesel fuel fumes remaining in an empty fuel tank form an extremely explosive mixture.

When the fuel pipes are being removed, a quantity of fuel will escape. To keep this quantity of fuel as limited as possible, unscrew the fuel-tank cap to release any overpressure. Any spilled fuel must be collected, bearing in mind the risk of fire.

Do not run the engine in an enclosed or unventilated area.
Make sure exhaust fumes are properly extracted.

Maintain a safe distance from rotating and/or moving components.

Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard. This also applies to engine coolant, windscreen washer fluid, refrigerant in air-conditioning systems, battery acid and diesel fuel.
So avoid inhaling and direct contact.

Exhaust gases contain carbon monoxide. Carbon monoxide is a deadly, colourless and odourless gas, which, when inhaled, deprives the body of oxygen, leading to asphyxiation. Serious carbon monoxide poisoning may result in brain damage or death.

It is recommended to always disconnect the battery's earth connection during repair or maintenance activities for which the power supply is not required.

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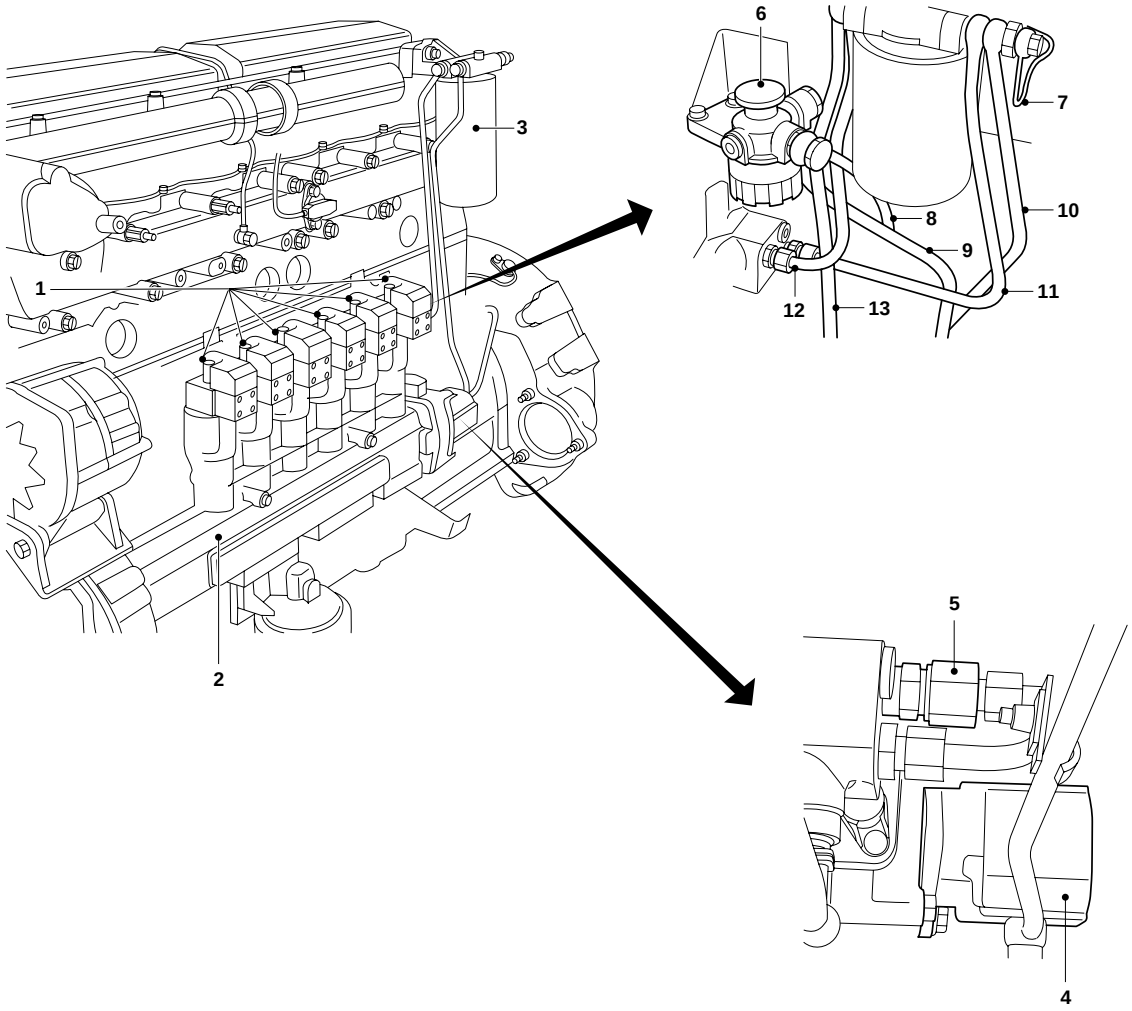
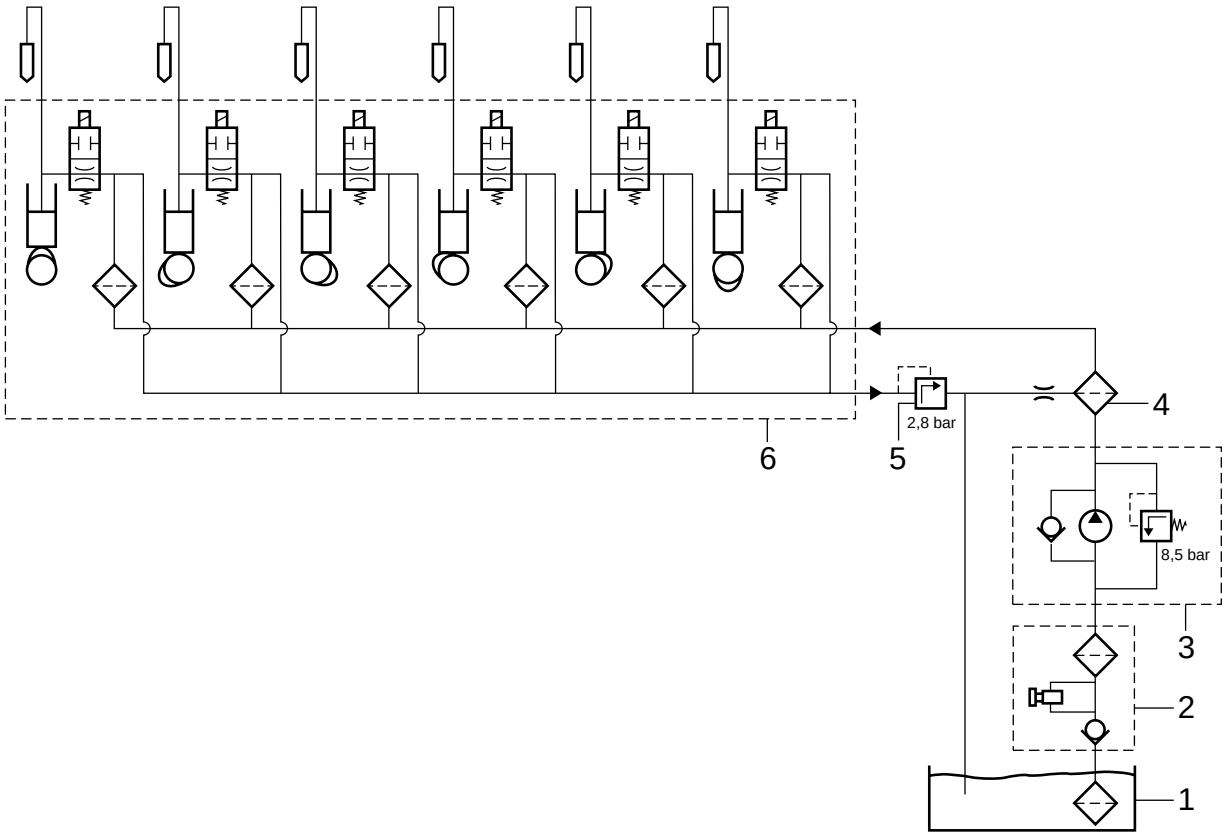
2. GENERAL

2.1 LOCATION OF COMPONENTS



1. Pump units with magnetic valve
2. Pump housing
3. Fuel fine filter
4. Fuel lift pump
5. Pressure-relief valve in pump housing
6. Hand pump with fuel coarse filter
7. Leak-off pipe
8. Supply pipe, hand pump
9. Pipe, hand pump - fuel lift pump
10. Fuel fine filter return line
11. Return pipe, pump housing
12. Pipe, fuel fine filter - pump housing
13. Pipe, fuel lift pump - fuel fine filter

2.2 DESCRIPTION OF UPEC FUEL SYSTEM



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The fuel lift pump (3) is installed against the pump housing (6) and is driven by the camshaft in the pump housing.
From the fuel lift pump the fuel is forced to the fuel fine filter (4).
To achieve permanent bleeding of the low-pressure area, a banjo bolt with a calibrated hole has been installed in the head of the fuel fine filter (4).
A small quantity of fuel will also escape through this calibrated hole.
But because the hole is so small, and the fuel supply is large, pressure will be built up in the fuel fine filter (4), and the fuel will be forced on to the pump housing (6).

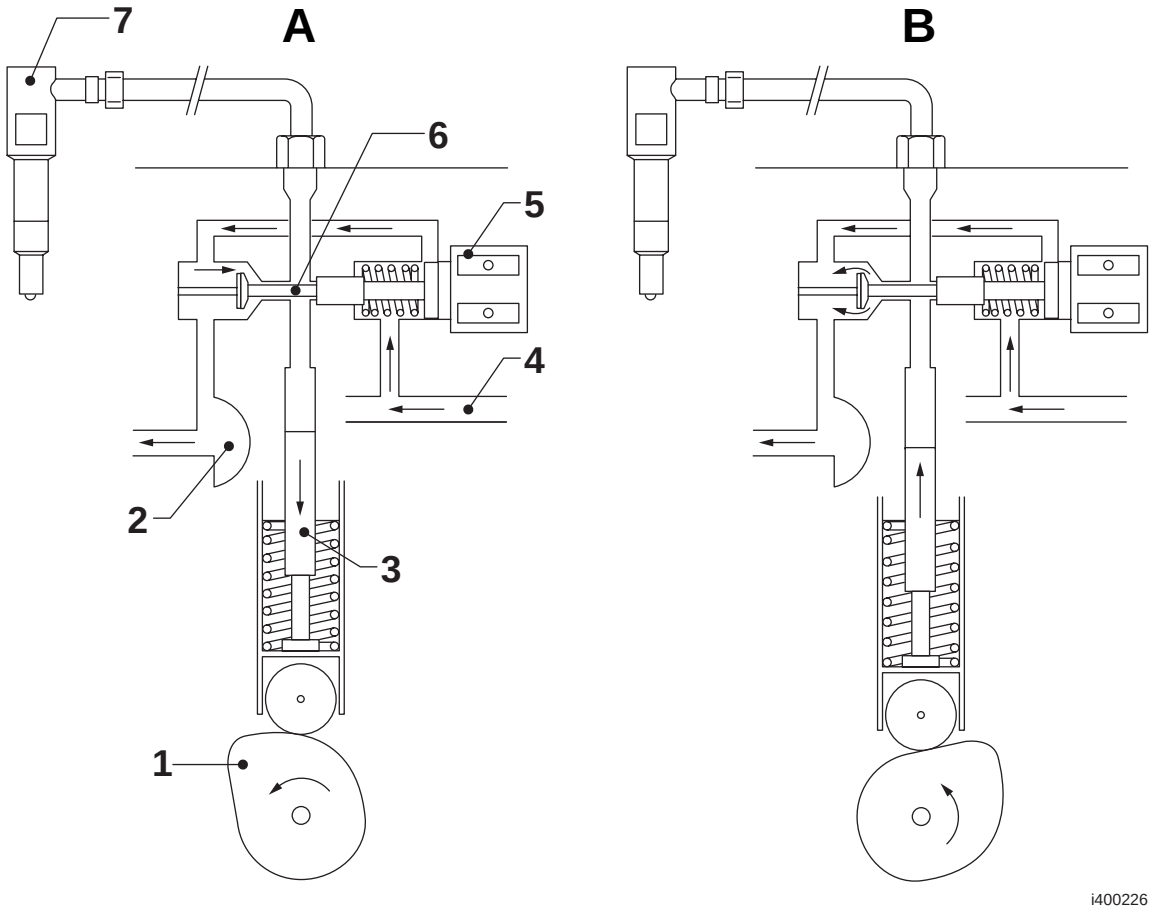
The pump housing (6) accommodates the pump units which are driven by the electronic unit. The pump units force the fuel to the injectors at a high pressure (approx. 1400 bar).

A pressure-relief valve (5) is installed on the return connection of the pump housing (6). This pressure-relief valve ensures that the pump units are filled properly.

A fuel coarse filter with hand pump (2) is also installed in the fuel system.
The hand pump is used to bleed the system after it has been “opened”.

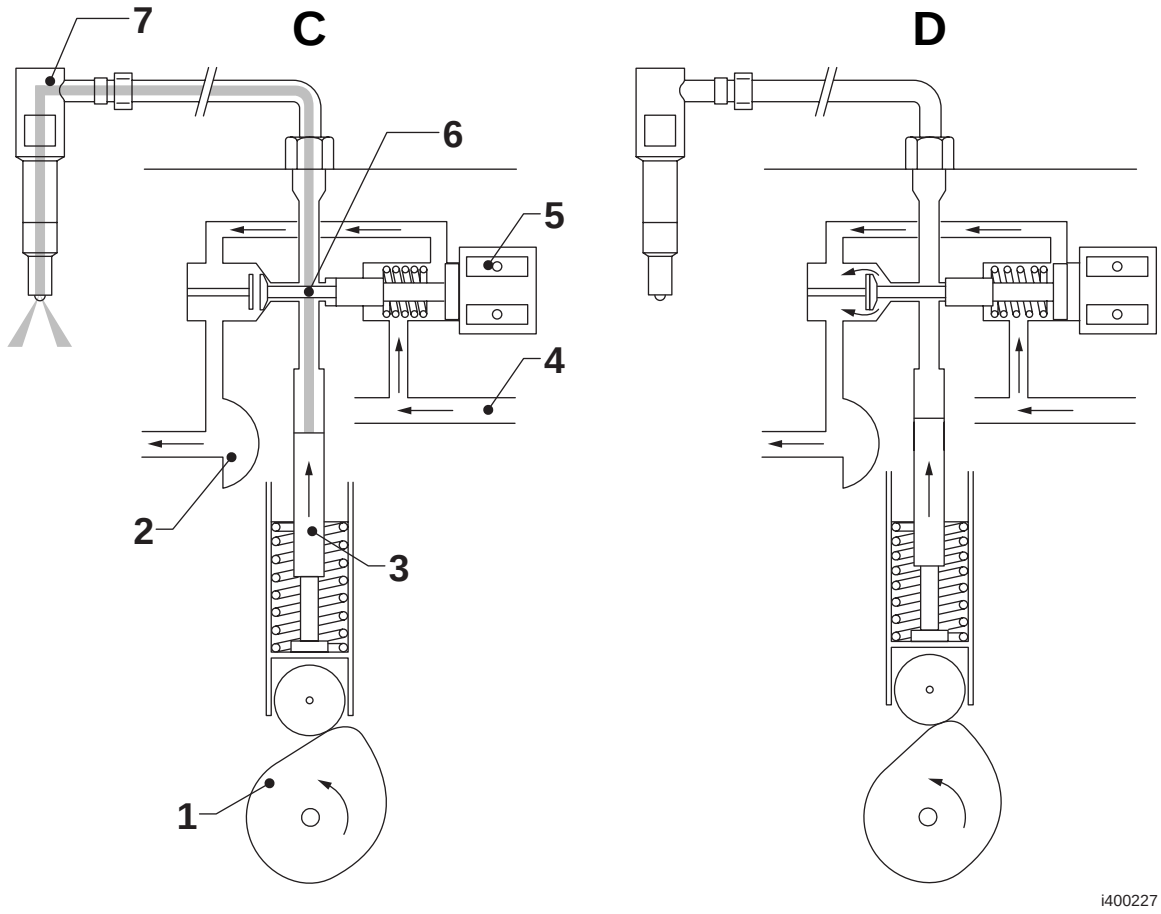
Pump unit

Principle of operation



Case A
In this case, the pump piston (3) performs the suction stroke.
Due to the permanent overpressure in the low-pressure area of the fuel system, the high-pressure area above the pump piston (3) is filled through the fuel supply pipe (4).

Case B
In this case, the pump piston (3) performs the delivery stroke.
Because the valve (6) has not yet shut off the connection with the fuel return connection (2), the fuel is forced into the fuel return.



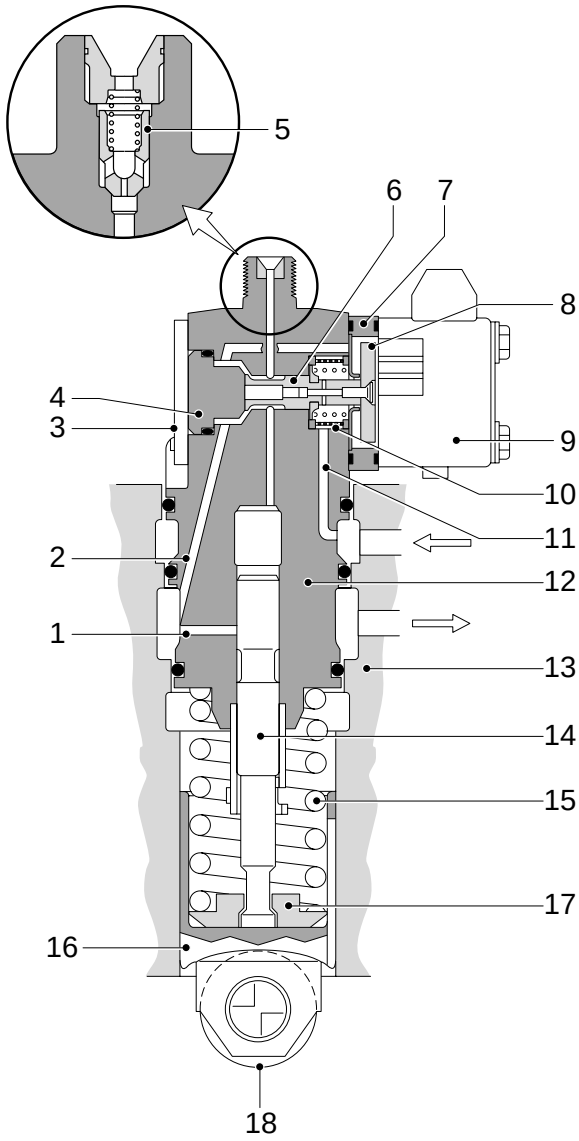
Case C
In this case, the injection timing is determined.
The solenoid (5) is activated by the electronic unit.
As a result, the valve (6) closes the connection between the high-pressure area above the pump piston (3) and the fuel return connection (2).
Pressure is built up above the pump piston (3), which causes fuel to be injected through the injector (7).

Case D
In this case, the quantity of injected fuel is established.
The solenoid (5) is no longer activated by the electronic unit.
As a result, the valve (6) opens the connection between the high-pressure area above the pump piston (3) and the fuel return connection (2).
The fuel pressure above the pump piston (3) is then reduced rapidly due to the expansion space in the return pipe.

Operation of the pump unit
The valve (6) with back plate (8) and the pump piston (14) are located at the top of the pump unit.
These parts are lubricated by the fuel.
The roller (18) with rocker roller (16) and spring (15) with spring retainer (17) are located at the bottom of the pump unit.
These parts are lubricated by the engine lubrication system.
The lower sealing ring of the pump unit separates the fuel system from the engine lubrication system.

A delivery valve (5) has been installed at the top of the pump unit.
The delivery valve serves to prevent the low-pressure area from being disturbed by the pressure peaks from the injection line.

Using a magnetic valve (9) consisting of a solenoid and valve (6) with back plate (8), the injection timing and quantity of injected fuel are controlled by the electronic control unit.



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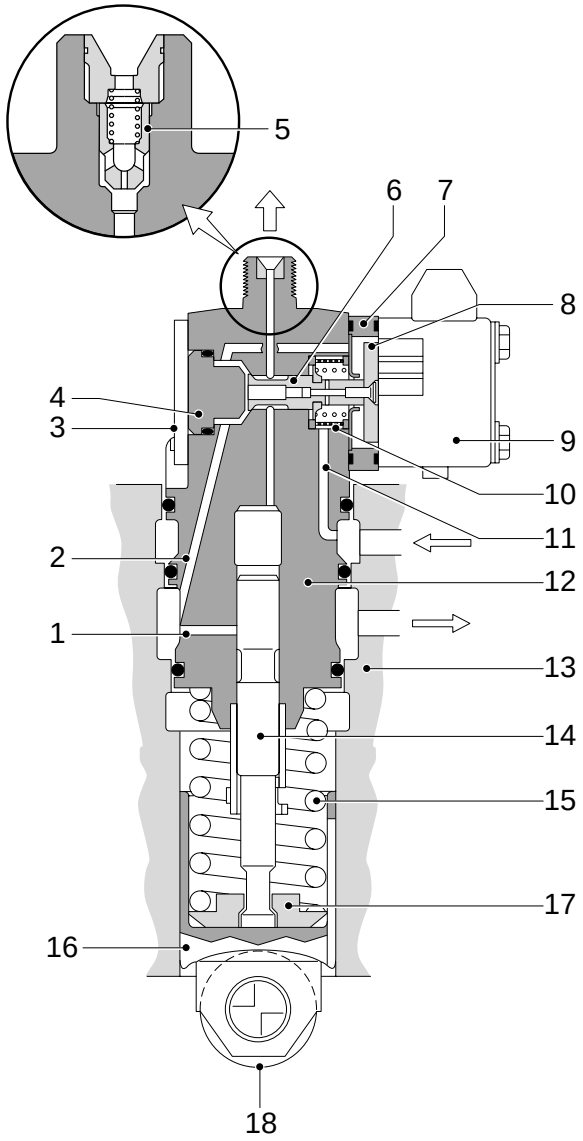
When the magnetic valve (9) is not activated, the valve (6) is pressed against the valve stop (4) by valve spring force.
This creates a very small opening between the high-pressure area above the pump piston (14) and the low-pressure area of the return bore (2).

The fuel flows to the fuel return bore (2) via the fuel supply bore (11) and the fuel filter (10). As a result, the high-pressure area above the pump piston (14) is also completely filled with fuel.
When the magnetic valve (9) is activated by the electronic unit, the back plate (8) with valve (6) will be attracted by the solenoid under the influence of the magnetic field.
Valve (6) closes the connection between the high-pressure and low-pressure areas, enabling pressure to be built up above the pump piston (14).
As a result, injection takes place.

Due to the high pressure in the high-pressure area the valve (6) is not re-opened against the magnetic force, because there is a state of balance in the groove of valve (6).
This is because the areas to the left and right in the groove of valve (6) are the same.

The time when valve (6) is closed depends on the injection timing calculated by the electronic unit.
The closure time of valve (6) and, consequently, the quantity of injected fuel, is also calculated by the electronic unit.



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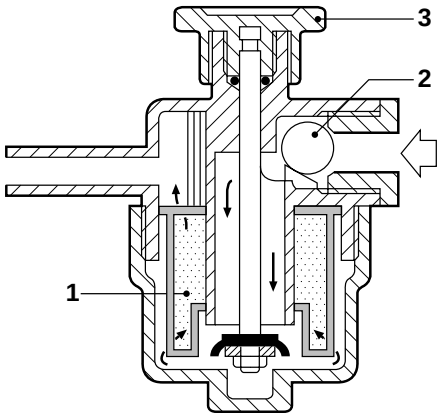
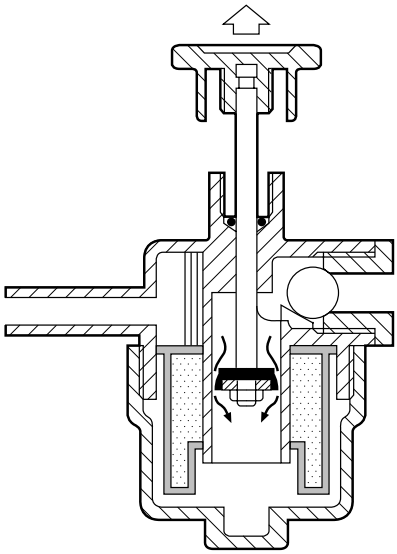
2.3 DESCRIPTION OF COMPONENTS

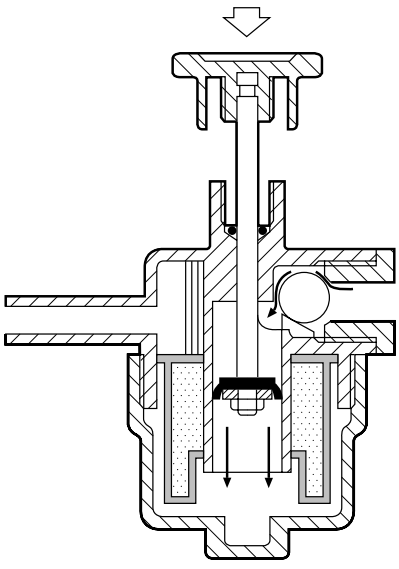
Hand pump with fuel coarse filter
A hand pump with fuel coarse filter is installed in the fuel system.
When the fuel is drawn in by the fuel lift pump, it flows to the suction side of the fuel lift pump via the non-return valve (2) and through the fuel coarse filter (1).



A hand pump (3) is installed to bleed the fuel system.
To operate the hand pump, it must first be released.
During the upstroke the volume above the piston of the hand pump is reduced.
As a result, the non-return valve (2) is closed and the fuel flows to the piston bottom along the piston seal.



During the downward stroke the volume below the piston of the hand pump is reduced.
The fuel is then forced to the fuel fine filter via the fuel lift pump.
At the same time, fuel is drawn in at the piston top via the non-return valve (2).
The hand pump must be re-tightened after it has been used.



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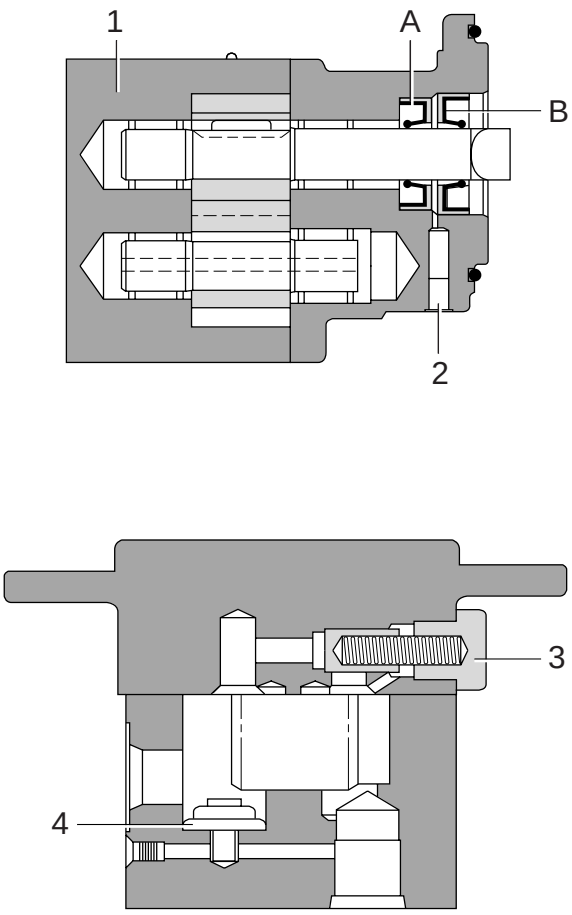
Fuel lift pump
The fuel lift pump (1) is installed at the rear of the pump housing and is driven by the camshaft in the pump housing.
The fuel lift pump is designed as a gear pump.

There is a pressure-relief space (2) at the bottom of the fuel lift pump.
This pressure-relief space prevents fuel from penetrating the lubricating-oil system in the event of leaks at sealing ring A and it prevents lubricating oil from penetrating the fuel system in the event of leaks at sealing ring B.
It also enables a visual inspection for any leaks.

A pressure-relief valve (3) has been installed in the fuel lift pump to protect the low-pressure area of the fuel system from too high a fuel lift pump pressure due to the flow resistance being too high.

Note:
When the fuel lift pump pressure is too high, the fuel filter element may be damaged and/or leaks may occur along the seals.

A non-return valve (4) has been installed in the fuel lift pump to bleed the fuel system.
This non-return valve is opened when the hand pump with the fuel coarse filter is operated.
As a result, a direct connection between the supply and discharge sides of the fuel lift pump is created.



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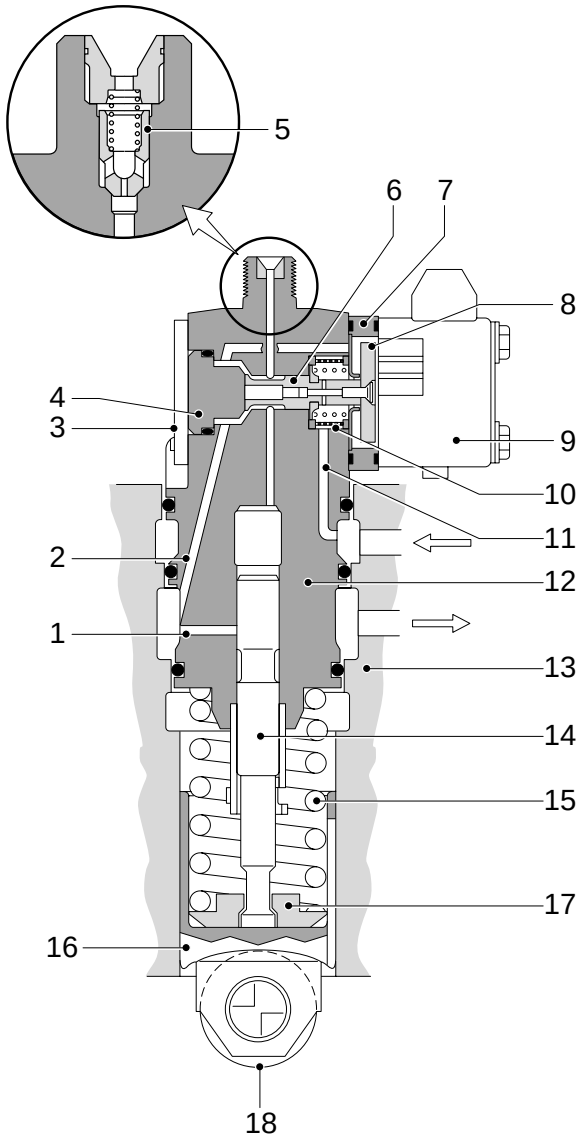
Pump unit
The valve (6) with back plate (8) and the pump piston (14) are located at the top of the pump unit.
These parts are lubricated by the fuel.
The roller (18) with rocker roller (16) and spring (15) with spring retainer (17) are located at the bottom of the pump unit.
These parts are lubricated by the engine lubrication system.
The lower sealing ring of the pump unit separates the fuel system from the engine lubrication system.

A delivery valve (5) has been installed at the top of the pump unit.
The delivery valve serves to prevent the low-pressure area from being disturbed by the pressure peaks from the injection line.

Using a magnetic valve (9) consisting of a solenoid and valve (6) with back plate (8), the injection timing and quantity of injected fuel are controlled by the electronic control unit.

When the magnetic valve (9) is not activated, the valve (6) is pressed against the valve stop (4) by valve spring force.
This creates a very small opening between the high-pressure area above the pump piston (14) and the low-pressure area of the return bore (2).

The fuel flows to the fuel return bore (2) via the fuel supply bore (11) and the fuel filter (10). As a result, the high-pressure area above the pump piston (14) is also completely filled with fuel.

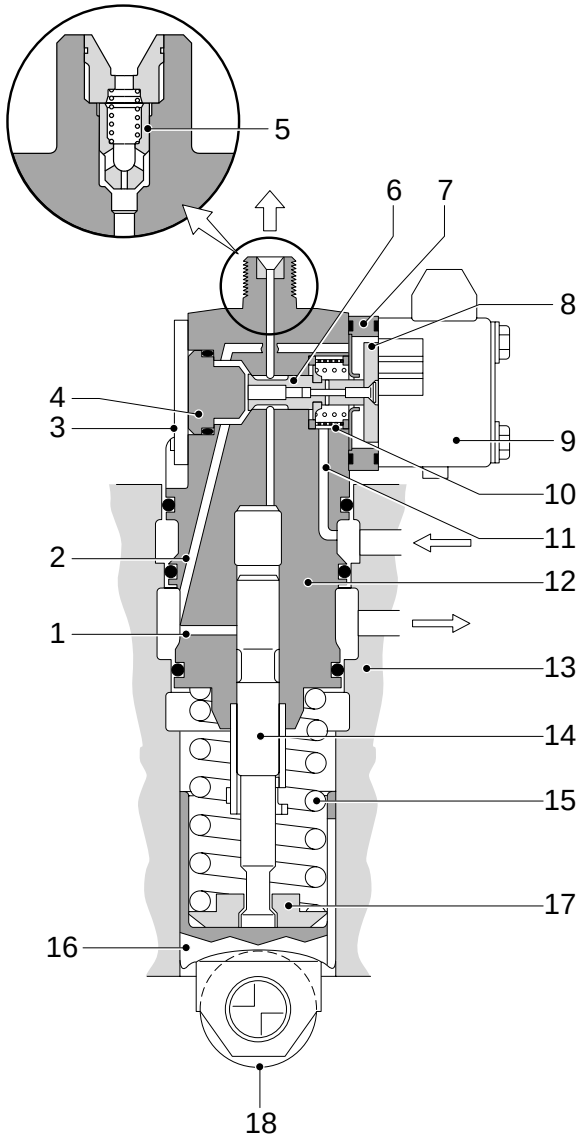


i 400411

When the magnetic valve (9) is activated by the electronic unit, the back plate (8) with valve (6) will be attracted by the solenoid under the influence of the magnetic field.
Valve (6) closes the connection between the high-pressure and low-pressure areas, enabling pressure to be built up above the pump piston (14).
As a result, injection takes place.

Due to the high pressure in the high-pressure area the valve (6) is not re-opened against the magnetic force, because there is a state of balance in the groove of valve (6).
This is because the areas to the left and right in the groove of valve (6) are the same.

The time when valve (6) is closed depends on the injection timing calculated by the electronic unit.
The closure time of valve (6) and, consequently, the quantity of injected fuel, is also calculated by the electronic unit.

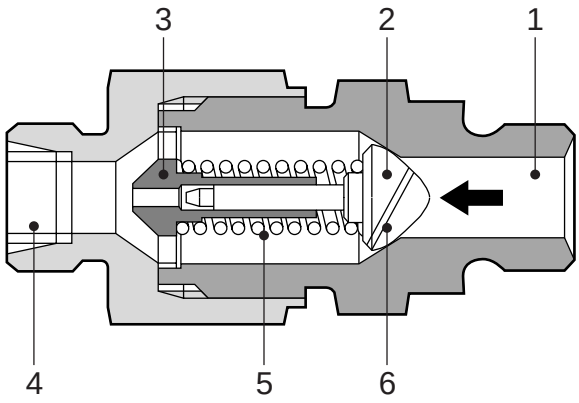


i 400412

Pressure-relief valve
To ensure a proper pump unit fill rate, a pressure-relief valve is fitted on the return connection of the pump casing.

The fuel flows from inlet (1) to outlet (4) via piston (2) and guide pin (3). The fuel meets resistance as a result of spring (5). This results in a pressure-relief valve opening pressure of approximately 2.8 bar.

A diagonal bore (6) is drilled in piston (2). This bore serves for bleeding the fuel system.



i400360

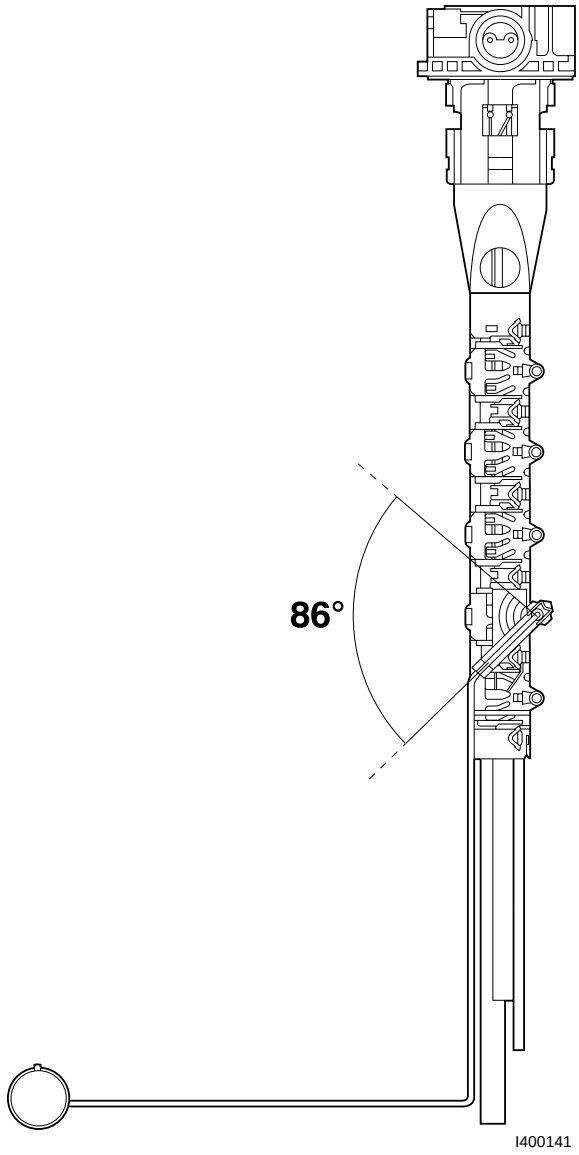
3. INSPECTION AND ADJUSTMENT

3.1 CHECKING THE FUEL LEVEL ELEMENT

To avoid deforming the fuel tank, the pressure in the fuel tank may not exceed 0.4 bar.

1. Fit a pressure reducing valve connection to a fuel filler cap (without bleeding) and connect it to the fuel tank.
2. Pressurise the fuel tank (maximum 0.1 bar).
3. Slowly increase the pressure, until one can hear the system blow off via the small overpressure valve and check the opening pressure of the fuel level element, see main group “Technical data”.
4. Depressurise the fuel tank and remove the fuel-tank cap with air connection.
5. **Note:**
   To prevent dirt from entering, first clean the exterior of the fuel tank.

   Remove the fuel level element.
6. Check the angular rotation of the fuel level element, see main group “Technical data”.



3.2 INSPECTION AND ADJUSTMENT OF INJECTOR OPENING PRESSURE

Fuel or test fluid discharged by an injector may penetrate the skin and be very harmful to your health. Make sure the fuel jet is discharged into a suitable container.

Checking the opening pressure with an injector test pump

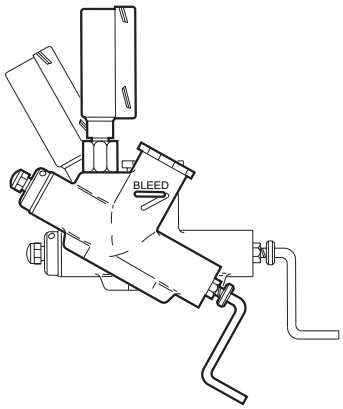
- The opening pressures of the injectors can be tested using an injector test pump (DAF no. 0694966). The advantage of this method is that the injectors need not be removed from the engine.

Instructions for the use of the injector test pump

Before the injector testing pump is used, it must first be bled.

1. Remove the pump reservoir filler cap and fill the reservoir with test fluid. The fluid level must be approximately 1 cm beneath the top rim.

2. Tilt the pump until the line with the word **"BLEED"** is in a horizontal position.

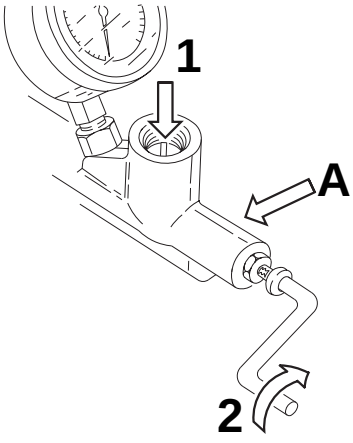


M4059

3. Depress the bleed pin (1) and simultaneously turn the crank (2) clockwise to the stop.
   During this operation, air bubbles will come to the surface in the reservoir. Now turn back the crank, fill the reservoir again and turn the crank until no more air bubbles come to the surface.
   Now release the bleed pin. Continue turning the crank until fuel escapes on the delivery side.

4. If necessary, fill the fuel reservoir and screw back the cap.

5. The pump is now ready for use.



M4058

Inspecting the injector opening pressure

1. Remove the injection lines in sets of three, see chapter “Removal and installation”. Immediately plug the connection openings on the fuel pump.

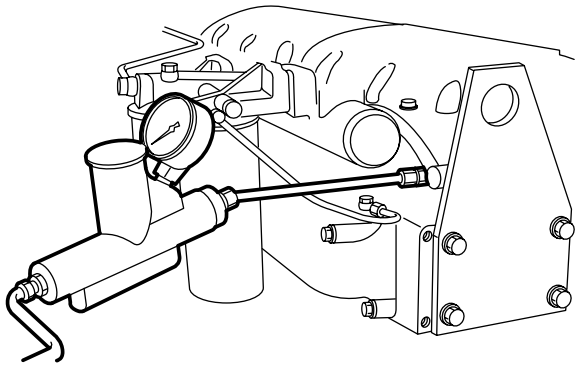
2. Connect the injection line (supplied with the injector test pump) to the injector to be tested and to the test pump. Keep the test pump approximately in horizontal position.

3. Loosen the test pump filler cap by half a turn, so that air can enter the reservoir.

4. Turn the crank of the test pump clockwise. The compression stroke starts. Watch the fluid level in the test pump.

5. Carefully determine the opening pressure of the injector. There is no harm in repeating the test twice or three times. If the test is repeated too often, however, the test fluid deposited on the piston may cause damage to the engine when it is started.

6. Reinstall the injection lines, see chapter “Removal and installation”.

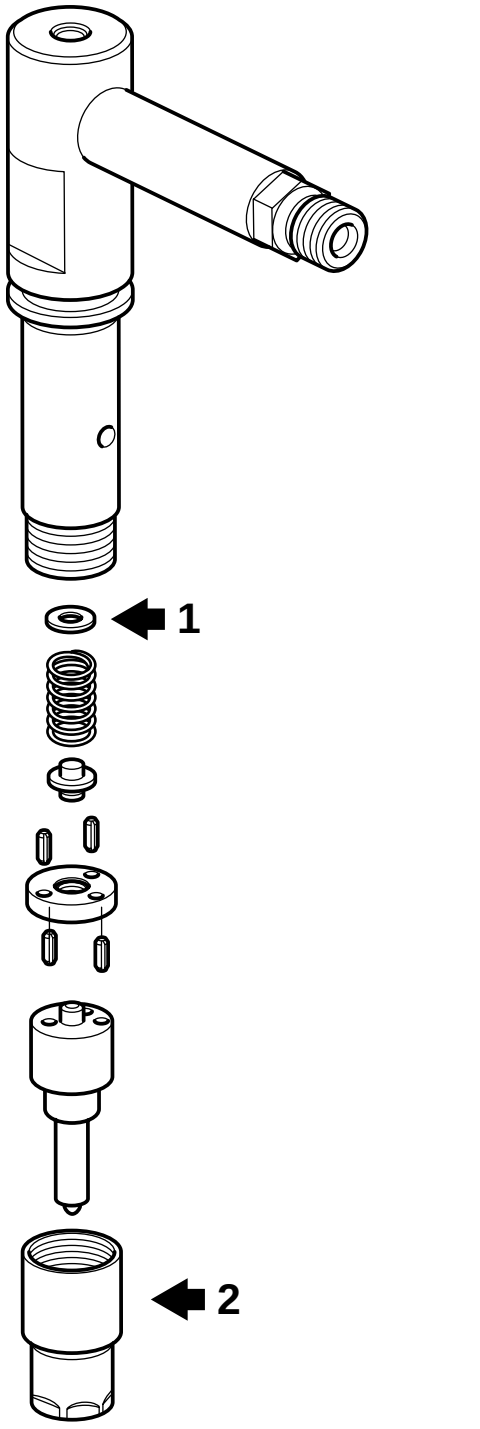

i 400190

Adjusting the injector opening pressure

Note:
The test pump can also be used to test injectors outside the engine. The bottom of the test pump can be clamped in a vice without causing damage to the test pump.

1. Remove the injector, see chapter “Removal and installation”.
2. Disassemble the injector, see chapter “Disassembly and assembly”.
3. Adjust the opening pressure by fitting a thicker or thinner shim (1). For pressure settings, see main group “Technical data”.

   Note:
   An increased shim thickness of 0.01 mm raises the pressure by approx. 1.5 bar.
4. Assemble the injector, see chapter “Disassembly and assembly”.
5. Fit the injector, see chapter “Removal and installation”.



i 400217

3.3 INSPECTION OF INJECTOR OPERATION

Fuel or test fluid discharged by an injector may penetrate the skin and be very harmful to your health. Make sure the fuel jet is discharged into a suitable container.

Evaluating the spray pattern, spray angle, and sound is practically impossible. New injectors or injectors which have been used for some time cannot be tested in this way.

1. Place the injector on an injector tester.
2. First allow the injector to inject a number of times.
3. Check the injector for:
   - opening pressure
   - leaks
   - nozzle holes.

Opening pressure

1. Check the opening pressure by slowly building up the pressure inside the injector.

Leaks

1. Dry the nozzle immediately after the final injection.
2. Increase the pressure to the opening pressure minus 20 bar. Within approx. 10 seconds, fuel must have ceased to leak from the nozzle. A moist nozzle is permitted. If the injector does not pass the fuel leakage test, the injector body (nozzle) must be replaced.

Nozzle holes

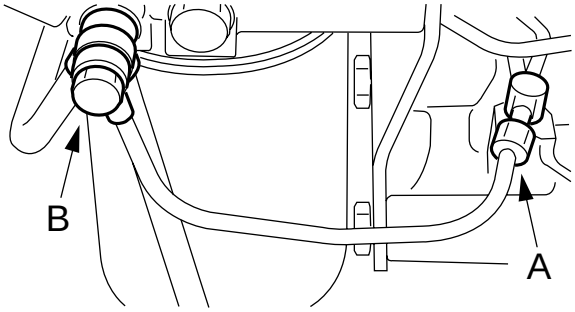
1. Quickly build up pressure in the injector and check whether all the holes are fully open.

3.4 INSPECTION OF FUEL SYSTEM FOR LEAKS

To avoid deforming the fuel tank, the pressure in the fuel tank may not exceed 0.4 bar.

1. Fit a pressure reducing valve connection to a fuel filler cap (without bleeding) and connect it to the fuel tank.
2. Dry the inspection points.
3. Pressurise the fuel tank (maximum 0.2 bar).
4. Open the union nut (A) a few turns to check whether the non-return valve is leaking into the banjo bolt (B). If it is leaking, this banjo bolt should be replaced.
5. Check the entire fuel system (low pressure area) for leakage.
6. Depressurise the system and replace the banjo bolt with integrated non-return valve in the filter head with a normal banjo bolt.
7. Remove the valve covers.
8. Re-pressurise the system (maximum 0.2 bar).
9. Check the leakage seal and the side connection of the injectors for leakage.

   Note:
   Engine oil may be used to detect leaks at the O-ring.
10. Fit the valve covers.
11. Replace the normal banjo bolt with a banjo bolt with integrated non-return valve.



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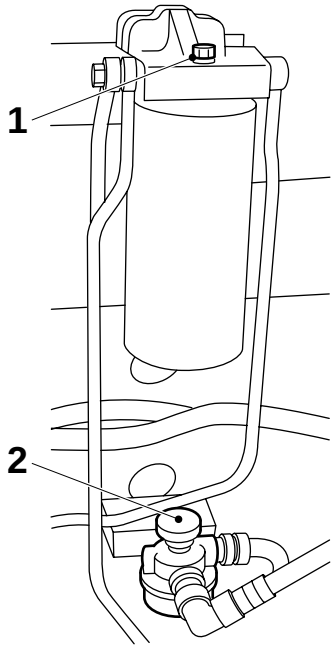
3.5 BLEEDING OF FUEL SYSTEM

Fuel is released during bleeding of the fuel system. This fuel must be collected, bearing in mind the risk of fire.

Any dirt in the system may cause severe damage to the pump units and the pump housing.

1. Open the bleed bolt (1) on the filter housing.
2. Using the hand pump (2), pump fuel through the system until fuel without air bubbles comes out of the bleed bolt (1).
3. Close the bleed bolt (1).
4. Loosen the union nut on the injector.
5. Using the hand pump (2), pump fuel through the system until fuel without air bubbles comes out of the injection line.
6. Tighten the union nut to the specified tightening torque, see main group “Technical data”.
7. Repeat the actions described in points 4, 5 and 6 for the other injectors.



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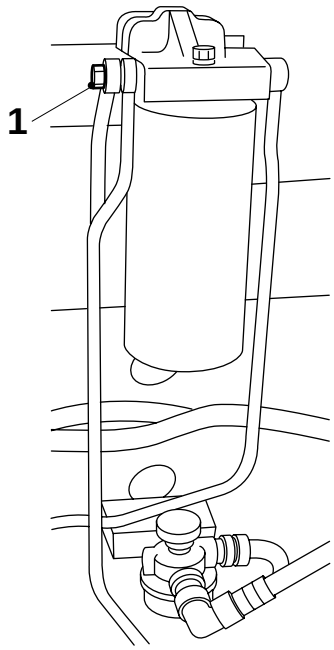
3.6 CHECKING THE GALLERY PRESSURE

Fuel is released when the gallery pressure is checked. This fuel must be collected, bearing in mind the risk of fire.

Any dirt in the system may cause severe damage to the pump units and the pump housing.

1. Place a tray beneath the fuel fine filter to capture any escaping fuel.
2. Remove the banjo bolt (1) from the head of the fuel fine filter.
3. Connect an attenuated fluid-type pressure gauge with a range of 0 - 10 bar to the cleared connection.
4. **Note:**
   To allow the gallery pressure to be checked at starting speed, the fuses of the UPEC-engine management system should be removed before and after contact in the central box. This is done to prevent the engine from picking up and to avoid error messages.

   Successively check the gallery pressure at idling, full-load and starting speed and compare the measured values with the values specified, see main group “Technical data”.
5. Remove the pressure gauge and fit the banjo bolt, tightening it to the specified torque, see main group “Technical data”.
6. Bleed the fuel system.



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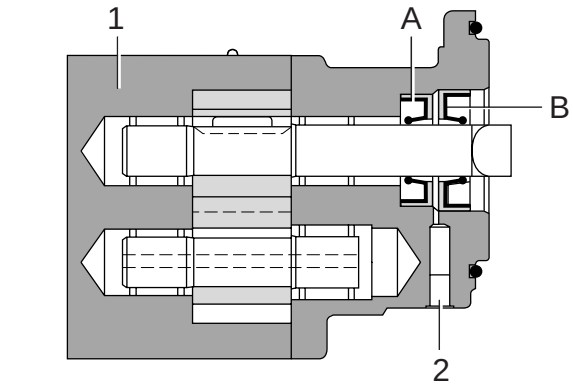
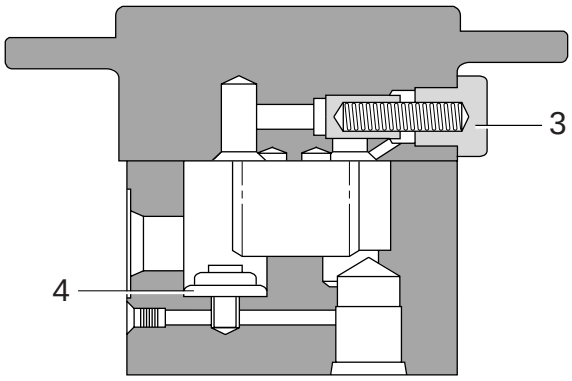
3.7 INSPECTION OF FUEL LIFT PUMP SEALING RINGS

1. Check via the pressure-relief space (2) at the bottom of the fuel lift pump (1) whether there are any leaks through the sealing rings.
2. In the event of leaks via sealing ring (A), there is fuel in the pressure-relief space. Any leaks via sealing ring (B) mean that there is engine lubricating oil in the pressure-relief space.
3. Check the fuel tank for air bubbles when the engine is running. A leak via sealing ring (A) may result in air getting into the fuel system and ultimately into the tank via the fuel return pipe.





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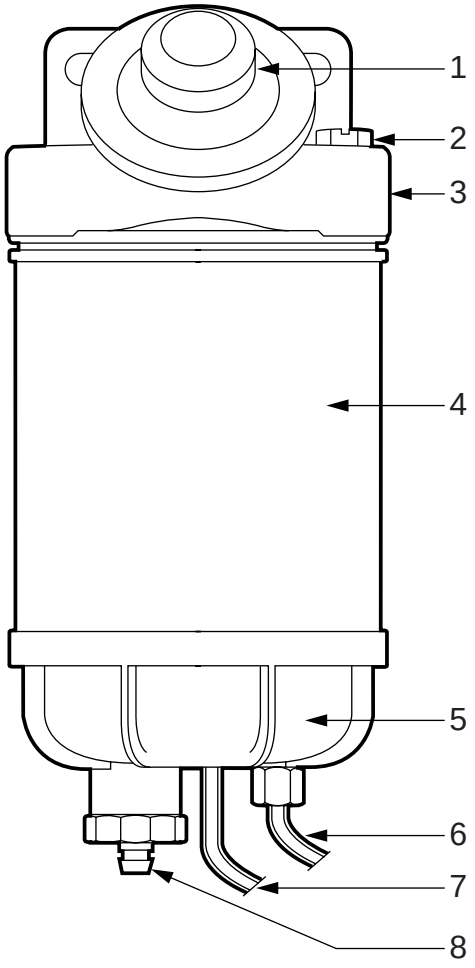
3.8 INSPECTION OF RACOR FILTER ELEMENT

1. Check the reservoir for the presence of water.
2. If necessary, drain the water via plug (2) using the fuel lift pump (1).



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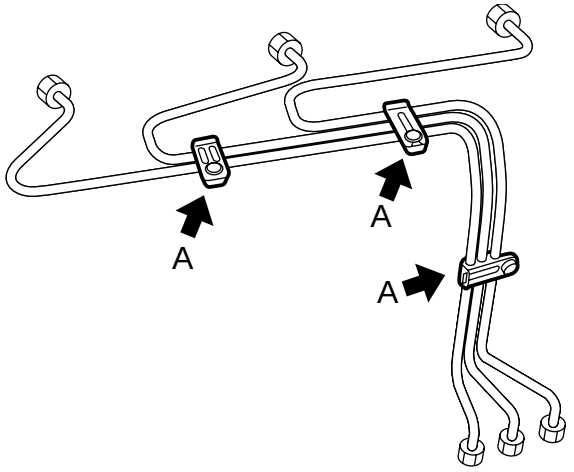
4. REMOVAL AND INSTALLATION

4.1 REMOVAL AND INSTALLATION OF INJECTION LINES

Always leave the injection lines fixed together, as a complete set. Never remove or shift the clamping brackets (A) holding the lines together. Never bend injection lines as they may crack.

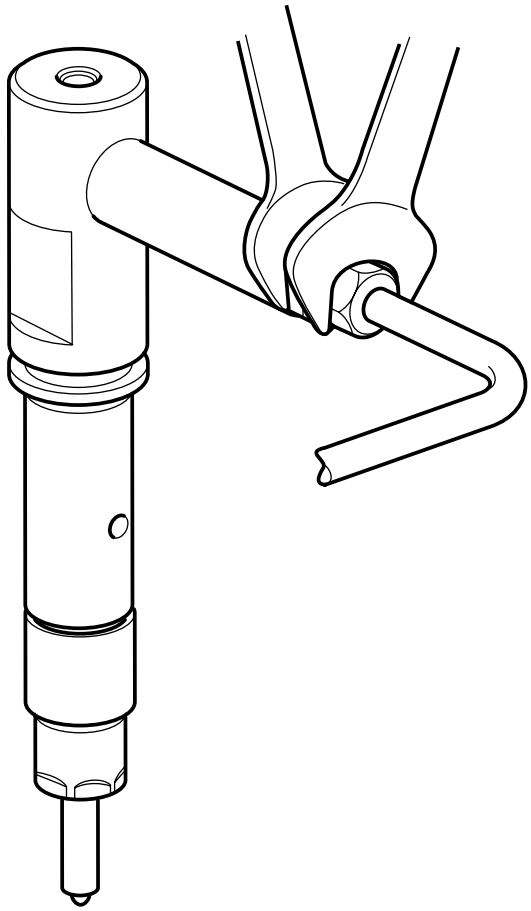


i 400199

Removing the injection lines

1. Clean the unions and the area surrounding the injectors and the pump housing.
2. **Note:**
   When slackening the injection-line unions, hold the injector's side connection back using an open-end spanner.

   Slacken the unions from the injection lines on the injector side.
3. Slacken the unions from the injection lines on the pump housing side.
4. Immediately plug the openings.
5. Remove the injection lines.



i 400237

Installing the injection lines

1. Purge the injection lines with dry compressed air.
2. Check whether the injector side connection is tightened to the specified tightening torque, see main group “Technical data”.
3. Fit the injection lines.
4. **Note:**
   When tightening the injection-line unions, hold the injector’s side connection back using an open-end spanner.

   Tighten the union nuts of the injection lines to the specified tightening torque, see main group “Technical data”.

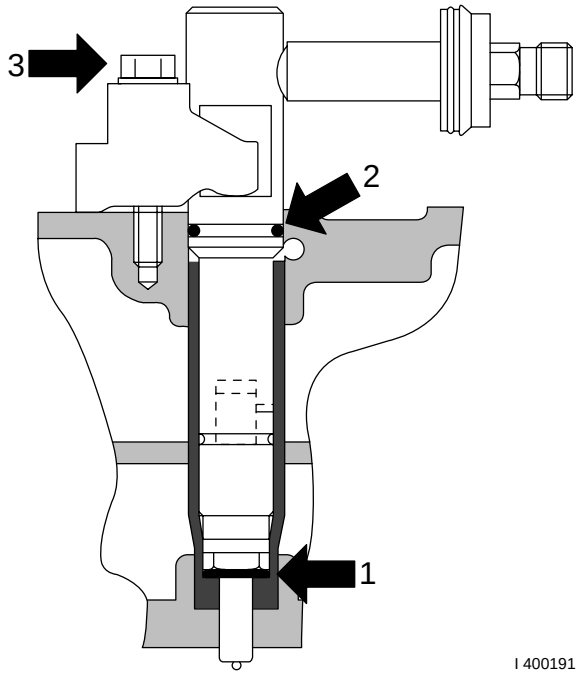
4.2 REMOVAL AND INSTALLATION OF INJECTORS

Because there is overpressure in the fuel tank, fuel may penetrate the cylinders when the injectors are removed. Therefore, when removing injectors, always take off the fuel-tank cap first. Collect any fuel leaving the injectors.

Note:
If the engine has been fitted with a DEB, the latter must be removed before the injectors can be removed.
While the DEB is being installed, both the DEB clearance and the valve clearance must be adjusted.

Removing the injectors
1. Remove the injection lines.
2. Remove the valve covers.
3. Remove the DEB, if fitted.
4. Remove the attachment bolt (3) of the injector clamp.
5. To remove the injector and the clamp, **only** use the special tools (DAF no. 1329412 and DAF no. 0694928).

Note:
If during removal one or more copper shims (1) remain in the injector sleeve, the injector will be reinstalled in a higher position.
- As a result, instead of spraying into the combustion chamber of the piston, the fuel will be sprayed onto the piston ring. This may seriously damage the piston.
- There will be inadequate sealing between the O-ring (2) of the injector and the cylinder head. Fuel leaking from the injector can freely flow into the engine and dilute the lubricating oil.

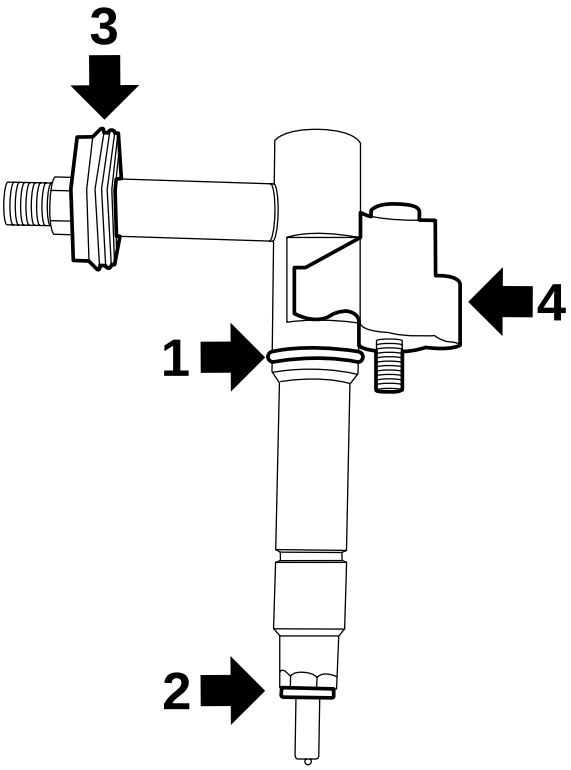


I 400191

Installing the injectors

1. Clean the injector sleeve, see chapter “Cleaning”.
2. Fit a new O-ring (1) and a new copper shim (2) on the injector. Apply a little acid-free grease to both rings.
3. Check the valve-sleeve sealing ring (3) of the injector. Replace it if leaking and/or damaged.
4. **Note:**
   Make sure that the injector clamp (4) is installed correctly.

   Install the injector together with the injector clamp (4) and tighten the attachment bolt to the specified tightening torque, see main group “Technical data”.
5. Fit the injection lines.
6. Check the injector seals for leaks, see “Checking and adjustment”.
7. Install the DEB, if present.
8. Fit the valve covers.

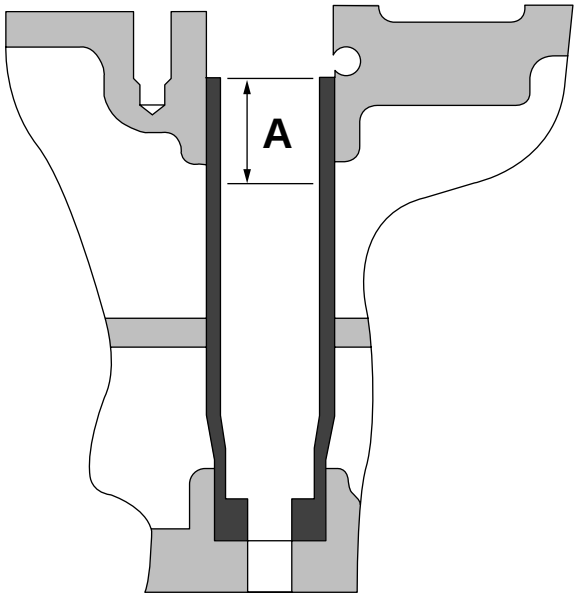


i 400183

4.3 REMOVAL AND INSTALLATION OF INJECTOR SLEEVES

Removing the injector sleeve

1. Drain part of the engine coolant.
2. Remove the injection lines.
3. Remove the injector.
4. Insert a ball of crumpled paper into the injector sleeve to prevent metal particles from entering the engine.
5. Cut thread (M22 × 1.5) in the injector sleeve to be removed over a length (A) of approx. 20 mm.
6. Insert the special tool (DAF no. 1310425) into the injector sleeve and use the special tool (DAF no. 0694928) to remove the injector sleeve.



I 400195

Installing the injector sleeve

1. Clean the injector-sleeve opening thoroughly.
2. **Note:**
   Install the injector sleeve **dry** into the cylinder head.

   Use the special tool (DAF no. 1329305) to tap the injector sleeve into the cylinder head.
3. Install the injector.
4. Fit the injection lines.
5. Fill the cooling system.

4.4 REMOVAL AND INSTALLATION OF PUMP UNIT

Fuel is released when the pump unit is removed. This fuel must be collected, bearing in mind the risk of fire.

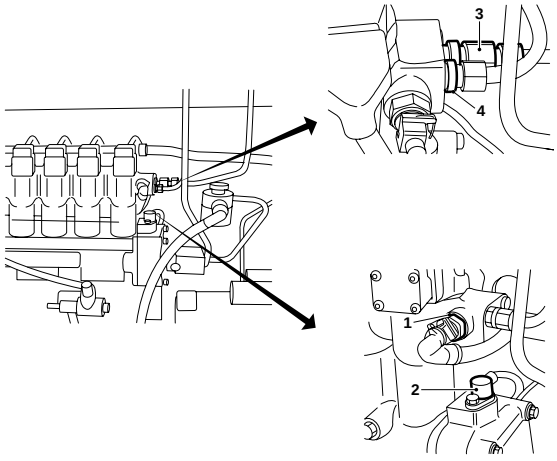
Any dirt in the system may cause severe damage to the pump units and the pump housing.

Removing the pump unit

1. Remove the electrical connections on the pump unit.
2. Remove the fuel pipes on the pump housing.
3. Remove the pressure-reducing valve (3) from the pump housing.
4. Allow the fuel to escape from the pump housing.
5. Remove the injection lines and plug the pump units and injectors to prevent the penetration of dirt.
6. If the pump unit(s) need not be replaced, the pump unit(s) must be marked to ensure that they are reinstalled in the same position in the pump housing.

The pump unit may be spring-tensioned, depending on the position of the camshaft in the pump housing.

7. Remove the attachment bolts from the pump unit.
8. Remove the pump unit. If necessary, use special tools (DAF no. 0694928 and DAF no. 1329448).



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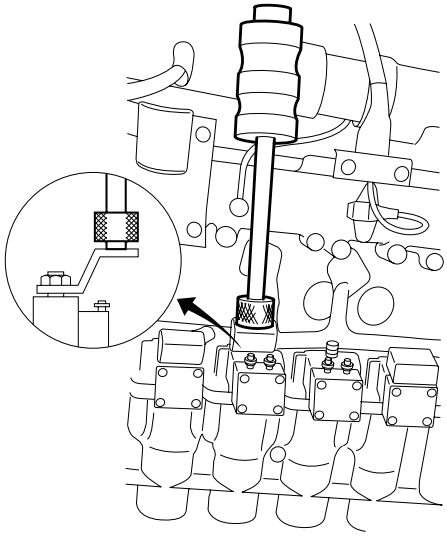
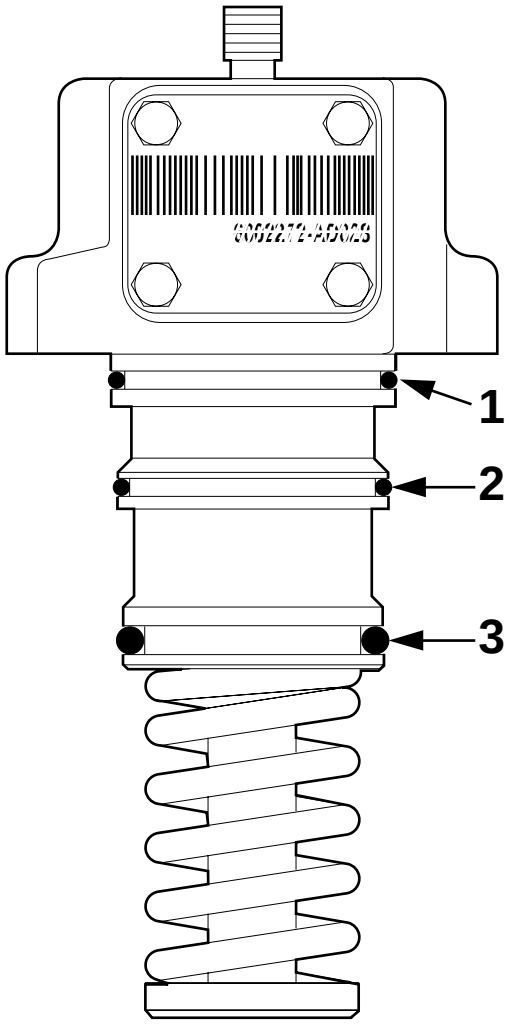

i 400396

Installing the pump unit

Lubricating oil may be diluted if a sealing ring is damaged.

1. Crank the engine until the camshaft in the pump housing is in such a position that the pump unit can be installed in the pump housing almost without spring tension.
2. Provide the pump unit with new sealing rings.
   Sealing ring (1) has the largest diameter and sealing ring (3) the smallest.
3. Apply a thin film of lubricating oil to the bores in the pump housing for the sealing rings.
4. Apply a thin film of lubricating oil to the new sealing rings of the pump unit and install the pump unit in the pump housing without damaging the sealing rings.
5. Fit the attachment bolts of the pump unit and tighten them evenly until the pump unit abuts on the pump housing.
6. Tighten the attachment bolts to the specified tightening torque, see main group “Technical data”.
7. Install the pressure-relief valve on the pump housing.
8. Install the fuel pipes on the pump housing.
9. Fit the injection lines.
10. Install the electrical connections on the pump unit.
11. Bleed the fuel system, see chapter “Inspection and adjustment”.



i 400221

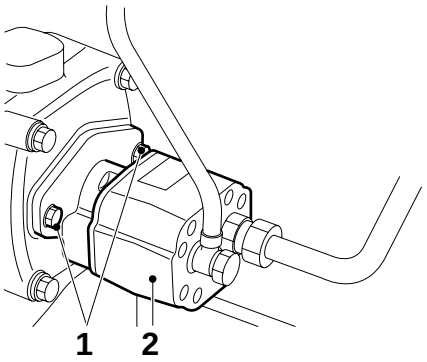
4.5 REMOVAL AND INSTALLATION OF THE FUEL LIFT PUMP

Fuel is released when the fuel lift pump is removed. This fuel must be collected, bearing in mind the risk of fire.

Any dirt in the system may cause severe damage to the pump units and the pump housing.

Removing the fuel lift pump

1. Remove the fuel pipes on the fuel lift pump.
2. Remove the attachment bolts (1) from the fuel lift pump (2).
3. Remove fuel lift pump.



i 400251

Installing the fuel lift pump

1. Check the fuel lift pump sealing ring for damage. If required, replace the sealing ring.
2. Lightly grease the fuel lift pump sealing ring with lubricating oil.
3. Apply a locking compound to the attachment bolts (1), see main group “Technical data”.
4. Install the fuel lift pump (2) using the attachment bolts (1).
   Make sure the cam of the fuel lift pump fits into the camshaft groove.
5. Tighten the attachment bolts evenly to the specified tightening torque, see main group “Technical data”.
6. Install the fuel pipes.
7. Bleed the fuel system, see chapter “Inspection and adjustment”.

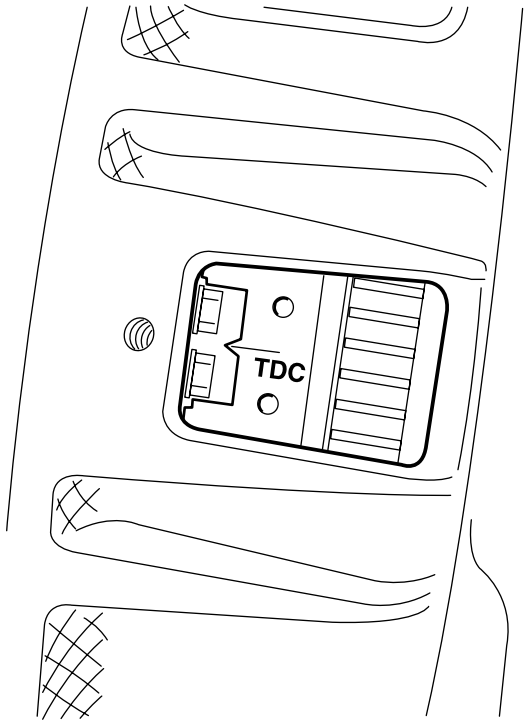
4.6 REMOVAL AND INSTALLATION OF PUMP HOUSING

Fuel is released when the pump housing is removed. This fuel must be collected, bearing in mind the risk of fire.

Any dirt in the system may cause severe damage to the pump units and the pump housing.

Removing the pump housing

1. Using special tool (DAF no. 1310477), turn the crankshaft until the valves of cylinder 6 are in rocking position and the TDC mark on the flywheel is in the correct position.
2. Remove the timing-gear cover.



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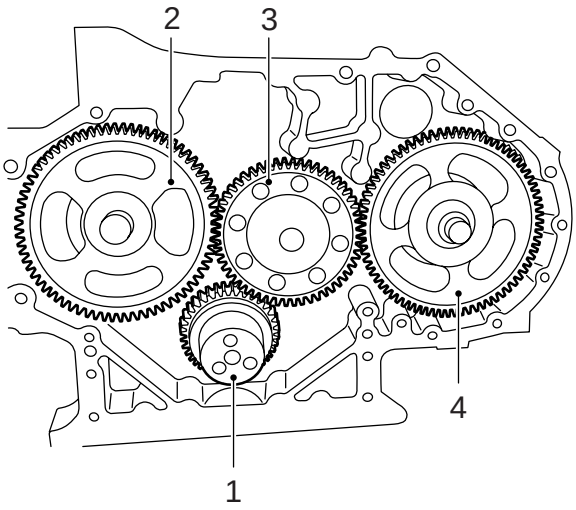
3. Remove the attachment bolt of the intermediate gear wheel (3) and pump housing camshaft gear wheel (4).
4. **Note:**
   When the crankshaft (1) or the camshaft (2) without intermediate gear wheel (3) is rotated separately, the engine's pistons may touch the valves.

   Remove the intermediate gear wheel (3).
5. Remove the pump housing camshaft gear wheel (4).



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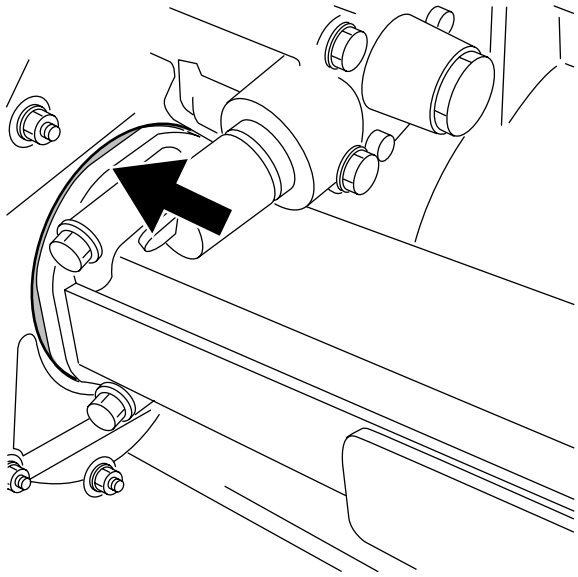
6. Remove the timing-gear case sealing ring by tapping it from the timing-gear case in the driving direction.
7. Remove the electrical connections on the pump units.
8. Remove the fuel pipes on the pump housing.



M200728

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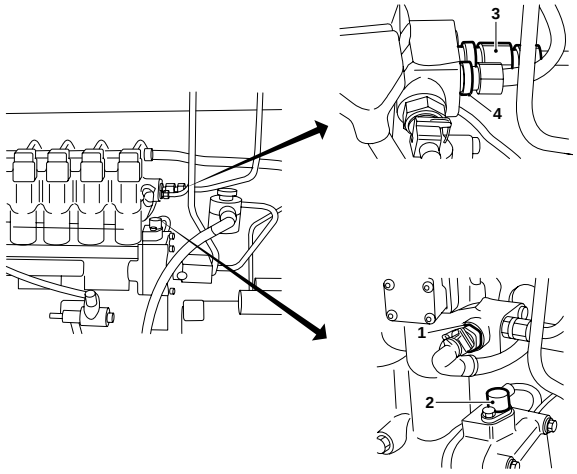
9. Remove the pressure-reducing valve (3) from the pump housing.
10. Allow the fuel to escape from the pump housing.
11. Remove the fuel pipes on the fuel lift pump.
12. Remove the injection lines and plug the pump units and injectors to prevent the penetration of dirt.
13. Remove the connector of the fuel temperature sensor (1).
14. Remove the camshaft position sensor (2).



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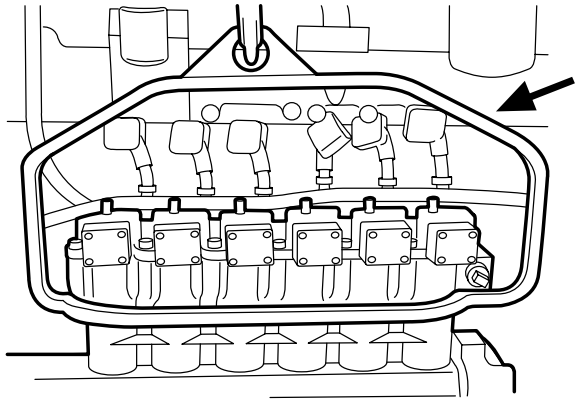
Considering the weight of the pump housing, use the special tool.

15. Install the lifting gear (DAF no. 1329391) on the pump housing.
16. Remove the attachment bolts from the pump housing and, using the lifting gear, remove the pump housing from the dowel pins on the engine block.



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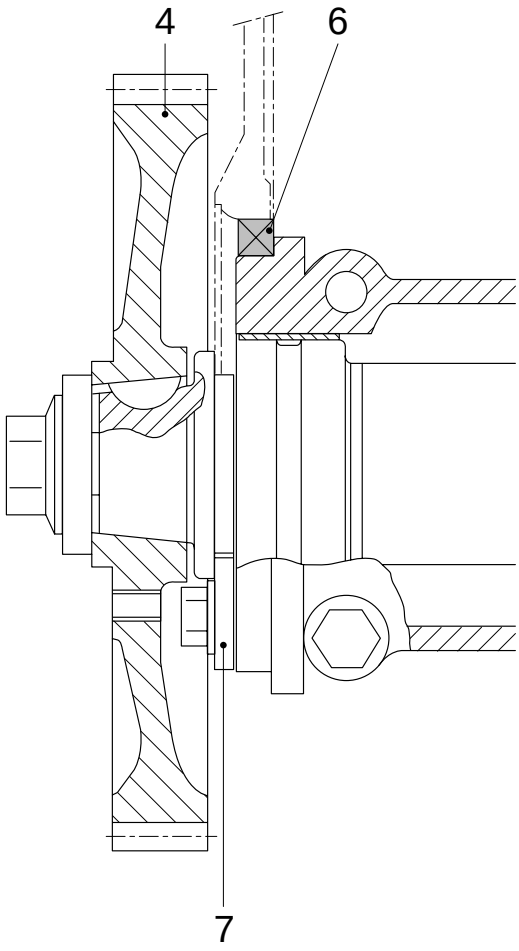
Installing the pump housing

1. Install the pump housing fitted with new sealing rings, using the lifting gear (DAF no. 1329391). Tighten the attachment bolts to the specified tightening torque, see main group “Technical data”.
2. Fit the camshaft position sensor.
3. Install the connector of the fuel temperature sensor.
4. Install the electrical connections on the pump units.
5. Fit the injection lines.
6. Install the fuel pipes of the fuel lift pump.
7. Install the pressure-relief valve on the pump housing.
8. Install the fuel pipes on the pump housing.
9. Install a dry new timing-gear case sealing ring (6) using special tool (DAF no. 1329318).



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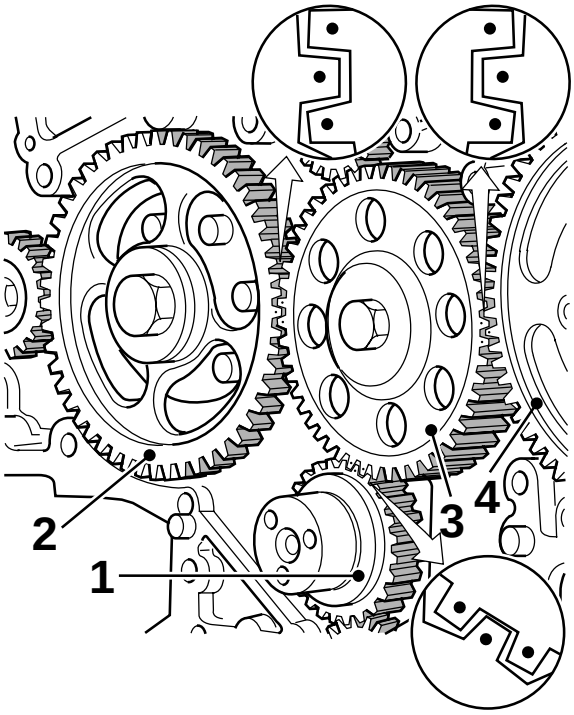
10. Check that cylinder 1 is in the top dead centre (TDC on the flywheel, cylinder 6 in rocking position).
11. Install the camshaft gear wheel (4) so that the intermediate gear wheel (3) can be installed in accordance with the marks.
12. Install the attachment bolts of the pump housing camshaft gear wheel (4) and the intermediate gear wheel (3) and tighten them to the specified tightening torque, see main group “Technical data”.
13. Install the timing-gear cover.
14. Bleed the fuel system, see chapter “Inspection and adjustment”.



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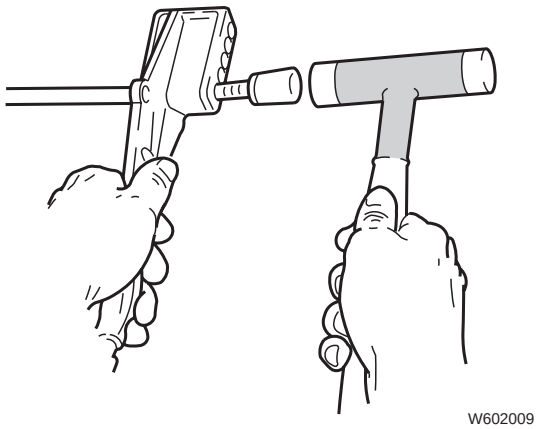
4.7 REMOVAL AND INSTALLATION OF FUEL PIPES

1. Cut off the pipe behind the nipple or banjo union. Remove the section of pipe from the nipple or banjo union, by heating. Never remove the nipple or banjo union by making an incision in the longitudinal direction of the pipe. This could easily result in damage to the hose adapter. Even minor damage to the hose adapter will cause leakage.
2. It is not permitted to fit a nipple or banjo union to the same pipe end more than once. If a nipple or banjo union were fitted to the same pipe end more than once, this could result in bad sealing.
3. Cut off the pipe end if it has been used before. If shortening the pipe results in a sharp curve in the pipe or if it makes the pipe too short, the pipe will have to be extended or a new pipe will have to be fitted.
4. Always install nipples and banjo unions in plastic pipes with the special tool (DAF no. 0694829).
5. Clamp the plastic pipe in the special tool.
6. **Note:**
   Never heat a plastic pipe when fitting nipples or banjo unions.

   Use a plastic mallet to tap the nipple or banjo union into the pipe.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Leaks from fuel pipes must be remedied as soon as possible to prevent fire risk.

In the event of a leakage from a pipe coupling, unlimited tightening of the union nut is not permitted.

1. First check whether the leak is at the connection point between the pipe and coupling or at the connection point between coupling and the component housing.
2. The union nut may be tightened a further half turn (180°) only once. Tightening the union nut further than this is possible, but entails the risk of excessive deformation of the thrust washer and the pipe, which would seriously weaken the pipe.
3. If the leakage has not stopped after the union nut has been tightened, it will be necessary to take the coupling apart.
4. Check the parts for deposits and/or damage. Even a small longitudinal scratch on the pipe adapter of a nipple or a banjo union may be sufficient to cause a leak.

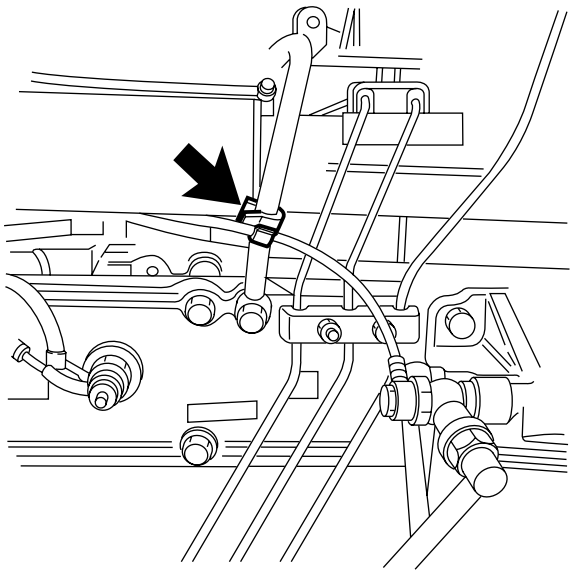
When pipes touch each other or other parts of the vehicle, they may get chafed.

1. Pipes showing evidence of wear must be replaced without delay.
2. When pipes are fitted close together or close to other parts of the vehicle, they should be secured to prevent chafing.
3. Secure pipes with the specially developed pipe clips. These pipe clips are available for pipes with a diameter of 6, 10 and 22 mm. The pipe clips can be joined together.

Clip diameter	DAF no.
6	0761460
10	0761462
22	0761461

4. Chafing can sometimes be prevented by releasing an elbow or T-piece and then tightening it in a slightly different position.
5. **Note:**
   Do not over tighten the cable ties, or the pipes may be forced shut.

   Secure the pipes with cable ties.



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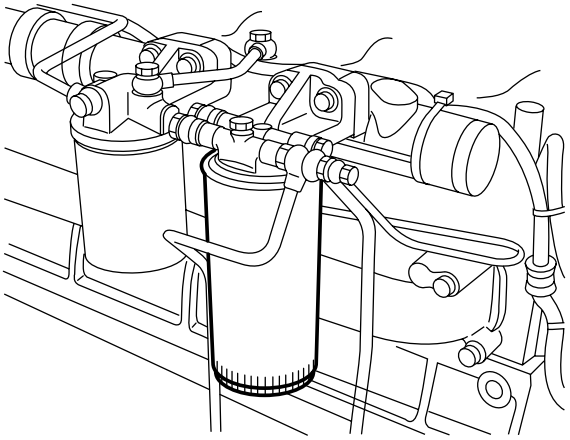
4.8 REMOVAL AND INSTALLATION OF FUEL FINE FILTER

When the fuel fine filter is removed, a quantity of fuel will escape. This fuel must be collected, bearing in mind the risk of fire.

Removing the fuel fine filter

1. Place a tray beneath the filter to collect any escaping fuel.
2. Remove the filter by turning it counter-clockwise.

   Note:
   The fuel fine filter is a disposable filter, and must neither be cleaned nor reused.



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Installing the fuel fine filter

1. Fill the new fuel fine filter with clean diesel fuel.
2. Lightly lubricate the sealing ring with engine oil.
3. Fit the filter until the sealing ring abuts and then tighten the filter by hand another $^{1}/_{2}$ to $^{3}/_{4}$ turn.
4. Bleed the fuel system, if necessary. See chapter “Inspection and adjustment”.
5. Start the engine and check for leaks. Manually re-tighten the filter, if necessary.

5

4.9 REMOVAL AND INSTALLATION OF FUEL COARSE FILTER

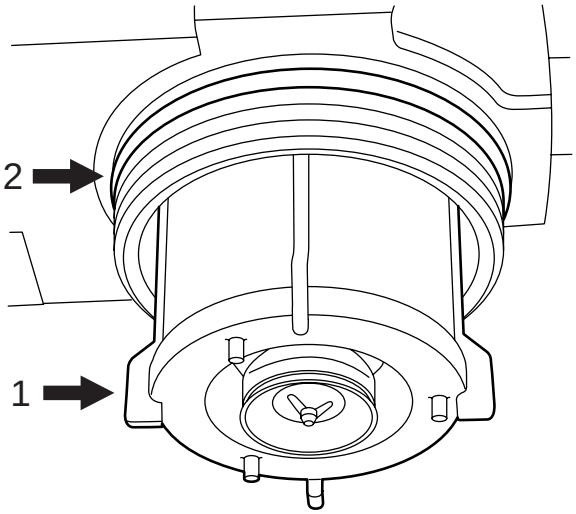
When the fuel coarse filter is removed, a quantity of fuel will escape. This fuel must be collected, bearing in mind the risk of fire.

Removing the fuel coarse filter

1. Place a tray beneath the filter to collect any escaping fuel.
2. Remove the cover by turning it counter-clockwise.
3. Remove the coarse filter (1).
4. Check the sealing ring (2) for damage. In case of damage, the sealing ring must be replaced.

Installing the fuel coarse filter

1. Apply a thin layer of acid-free grease to the sealing ring.
2. Fit the cover together with the coarse filter by fingertightening the cover.
3. Bleed the fuel system, if necessary. See chapter “Inspection and adjustment”.
4. Start the engine and check for leaks. Manually re-tighten the filter, if necessary.



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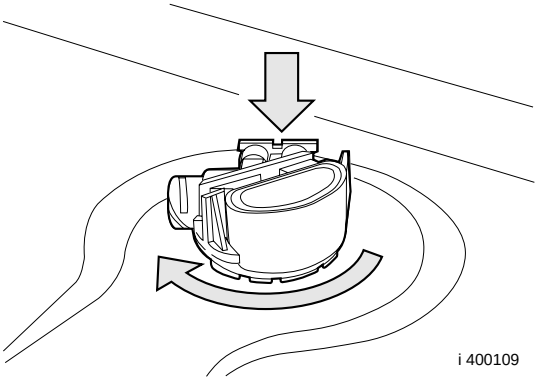
4.10 REMOVAL AND INSTALLATION OF FUEL LEVEL ELEMENT

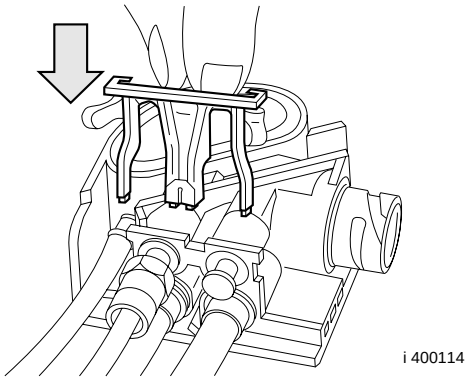
Removing the fuel level element

1. To prevent dirt from entering, first clean the fuel tank.
2. Remove the connector from the fuel level element.
3. Remove the fuel pipes from the fuel level element.
4. Turn the fuel level element a quarter turn counter-clockwise.
5. Remove the fuel level element from the fuel tank.
6. Remove the O-ring.



Installing the fuel level element

1. Fit a new O-ring.
2. Check whether the fuel pipes are fitted correctly in the tank filter.
3. Fit the fuel level element carefully in the fuel tank.
4. Insert the fuel level element into the hole of the tank and turn it clockwise a quarter turn.
5. Insert the fuel pipes into the fuel level element.
6. Install the connector of the fuel level element.



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4.11 REMOVAL AND INSTALLATION OF TANK FILTER

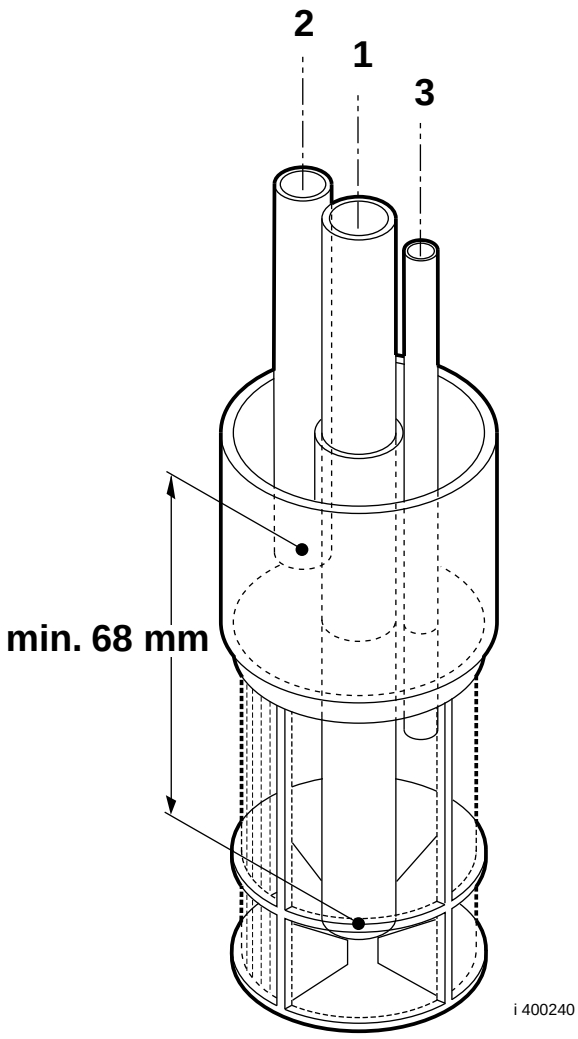
Removing the tank filter

1. Remove the fuel level element.
2. Remove the tank filter.

Installing the tank filter

1. Check that the difference in length between the supply line (1) and return line (2) is at least 68 mm.
2. Slide the tank filter as far as possible onto the supply line (1).

   Note:
   Make sure that the return line (2) is inserted into the tank filter by-pass as far as possible, and that the auxiliary heating supply line (3), if present, is inserted into the filter part.
3. Install the fuel level element.



4.12 REMOVAL AND INSTALLATION OF RACOR FILTER ELEMENT

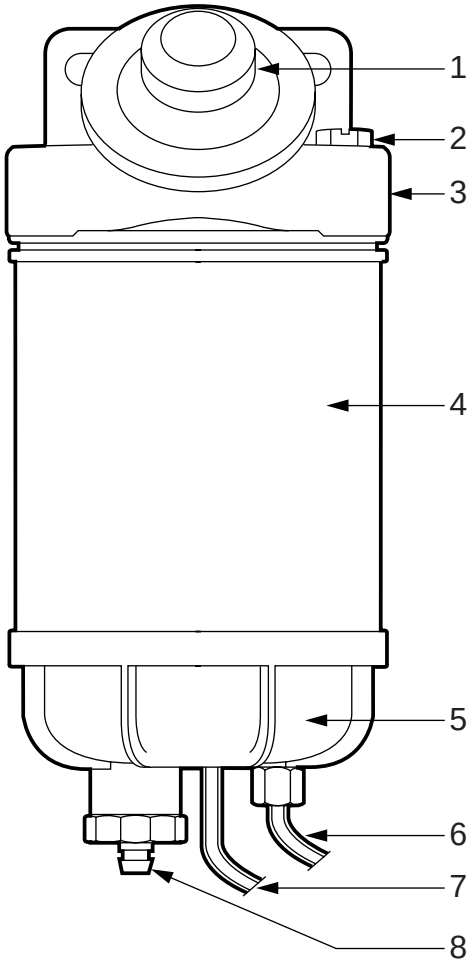
When the Racor filter element is removed, a quantity of fuel will escape. This fuel must be collected, bearing in mind the risk of fire.

Removing the Racor filter element

1. Drain the fuel from the filter element by loosening the bleeding plug (2) and opening the drain plug (8).
2. Loosen any connectors of the water sensor (6) and the heating element (7).
3. Remove the filter element (4) together with the bottom cover (5) and clean the O-ring sealing.

Installing the Racor filter element

1. Apply a film of engine oil to the O-ring and the new sealing ring.
2. Fit the bottom cover (5) to the new filter element (4) and fill clean diesel fuel.
3. Fit the bottom cover (5) together with the new filter element (4) to the filter housing (3).
4. Hand-tighten the filter.
5. Fit the water sensor connectors and the heating element, if present.



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5. DISASSEMBLY AND ASSEMBLY

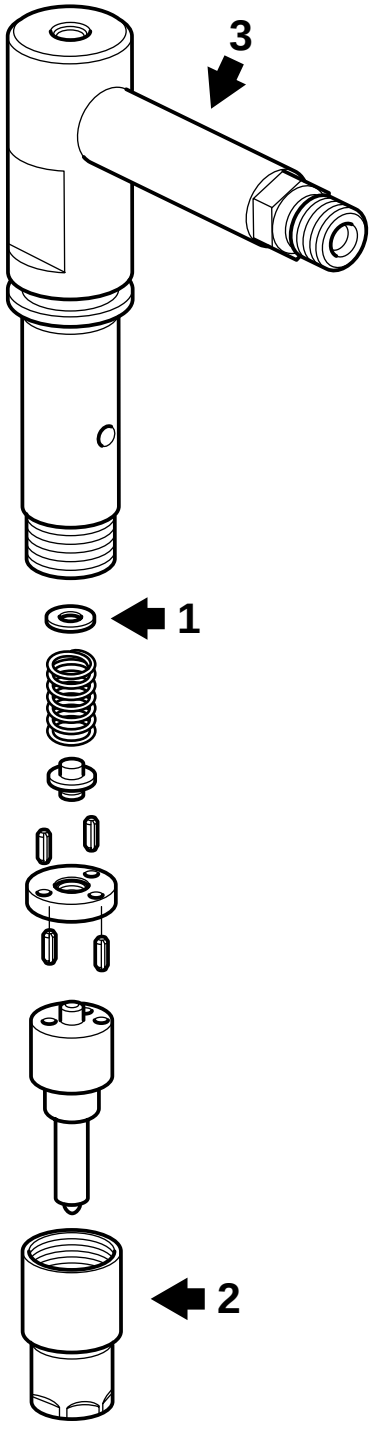
5.1 DISASSEMBLY AND ASSEMBLY OF INJECTOR

The injector side connection (3) must not be removed from the injector.

Disassembling the injector

1. Remove the injector, see chapter “Removal and installation”.
2. Clean the injector, see chapter “Cleaning”.
3. **Note:**
   Do not exchange injector bodies (nozzles) and injector needles because these constitute interrelated sets.

   Remove the union nut (2), after which the various parts can be taken from the injector.
4. Check that none of the injector parts have been compressed by the injector needle.



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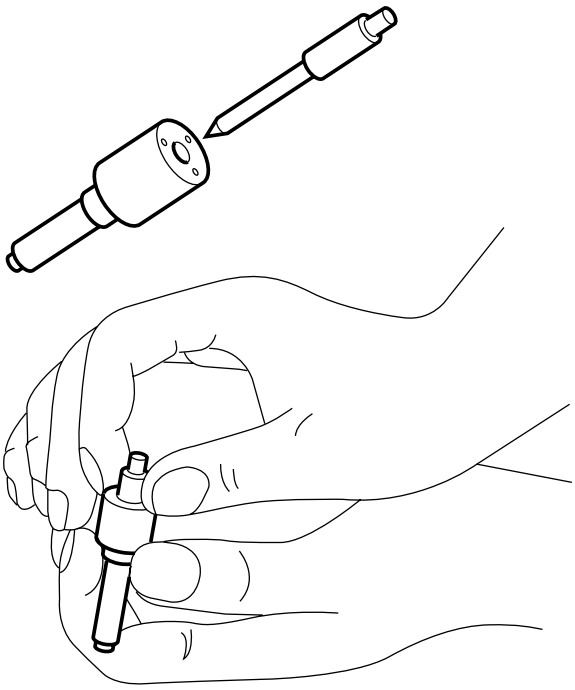
Assembling the injector

1. Immerse the injector needle and the injector body in clean diesel fuel.
   Insert the injector needle in the injector housing (nozzle).
   With the injector body held vertically, if the injector needle is lifted approx. 10 mm, it should slide downwards under its own weight.
2. Blow-clean all parts, and immerse them in clean diesel fuel.
3. **Note:**
   Ensure that there is no more diesel fuel on the screw thread, as it will cause the quality of the thread to deteriorate.

   Install the injector and tighten the union nut (2) to the specified tightening torque, see chapter “Technical data”.
4. Check the opening pressure of the injector, see chapter “Inspection and adjustment”.



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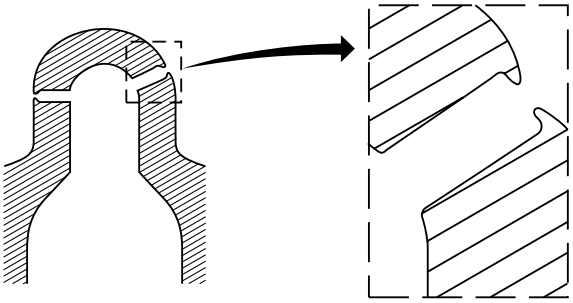
6. CLEANING

6.1 CLEANING INJECTOR

The injector must never be cleaned with a copper or steel wire brush. When cleaning the exterior of the injector nozzle, do not brush over the nozzle holes. If this is done nevertheless, the nozzle will have to be replaced.

The use of steel or copper wire brushes could lead to deformation of the nozzle holes as a result of which too little fuel would be injected. Such deformation cannot be detected by carrying out the normal injector test.



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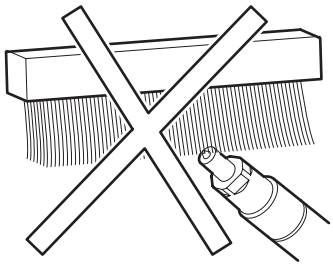
Cover the nozzle holes before cleaning the nozzle. Only clean the nozzle with the brass hand brush supplied with the injector cleaning set (DAF no. 1329371).



1. Determine the diameter of the injector nozzles to be cleaned, see main group “Technical data”.

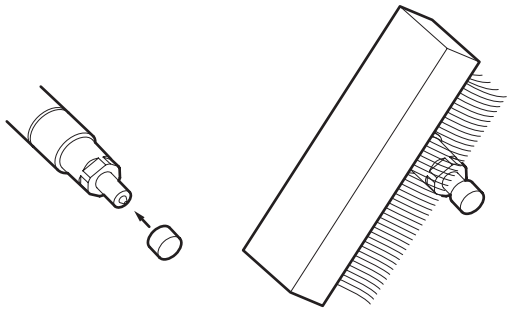
   Note:
   The diameter of the injector nozzles can be established using the nozzle number on the nozzle.

2. Disassemble the injector, see chapter “Disassembly and assembly”.

3. Clean the injector nozzles using an injector cleaning set (DAF no. 1329371).

   Note:
   The diameter of the needle must be approx. 0.02 mm less than the diameter of the nozzle.

4. Assemble the injector, see chapter “Disassembly and assembly”.



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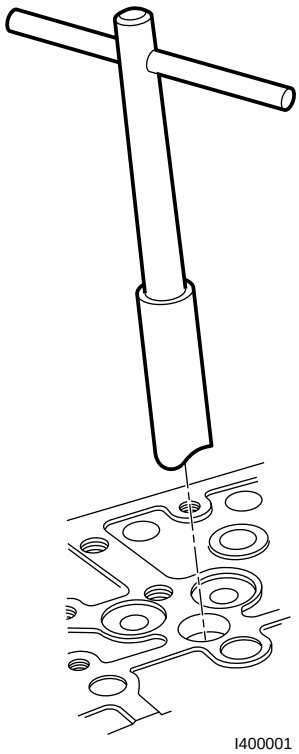
6.2 CLEANING INJECTOR SLEEVE

1. Remove the injector, see chapter “Removal and installation”.
2. Use the special tool (DAF no. 1240074) to remove any residual copper shim.
3. Use the special tool (DAF no. 1240074) to clean the injector sleeve.
4. Clean the injector sleeve with compressed air.
5. Fit the injector, see chapter “Removal and installation”.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6.3 CLEANING FUEL COARSE FILTER

1. Remove the fuel coarse filter, see “Removal and installation”.
2. Flush the coarse filter using clean diesel fuel.
3. Blow-clean the coarse filter, using compressed air; maximum pressure: approx. 1 bar.

CONTENTS

6

1. SAFETY INSTRUCTIONS

Do not run the engine in an enclosed or unventilated area.
Make sure exhaust fumes are properly extracted.

Maintain a safe distance from rotating and/or moving components.

Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard. This also applies to engine coolant, windscreen washer fluid, refrigerant in air-conditioning systems, battery acid and diesel fuel.
So avoid inhaling and direct contact.

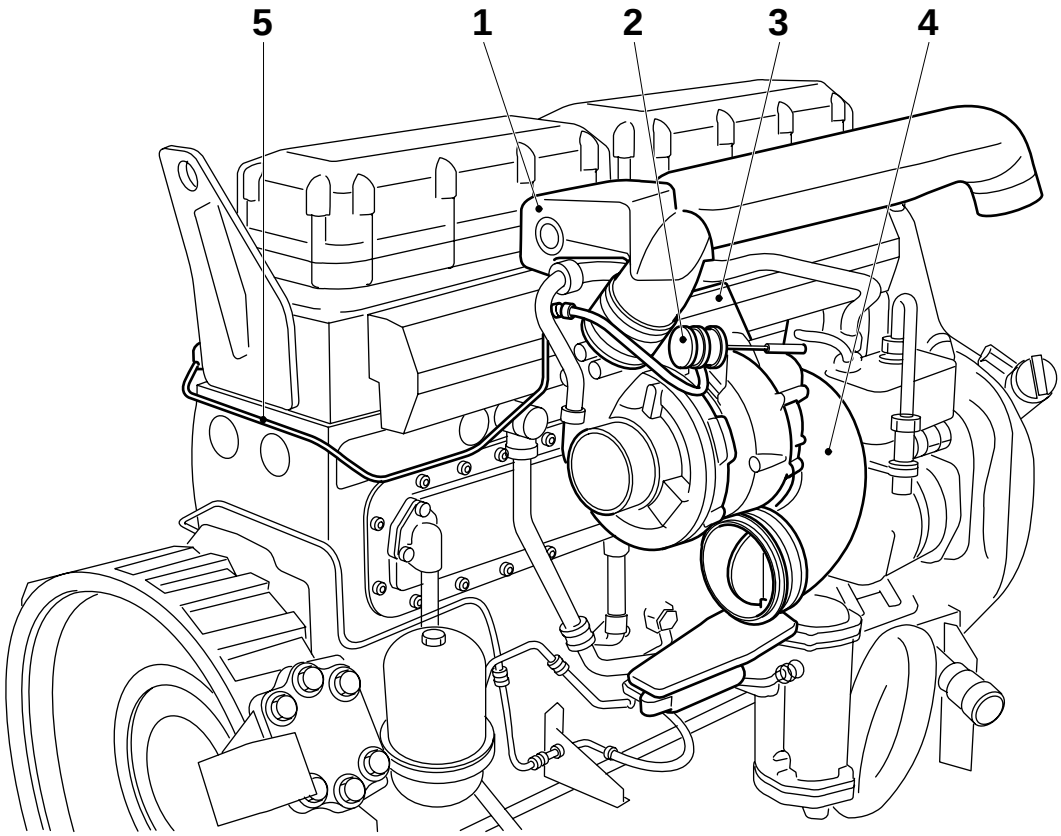
Exhaust gases contain carbon monoxide. Carbon monoxide is a deadly, colourless and odourless gas, which, when inhaled, deprives the body of oxygen, leading to asphyxiation. Serious carbon monoxide poisoning may result in brain damage or death.

It is recommended to always disconnect the battery's earth connection during repair or maintenance activities for which the power supply is not required.

6

2. GENERAL

2.1 LOCATION OF COMPONENTS



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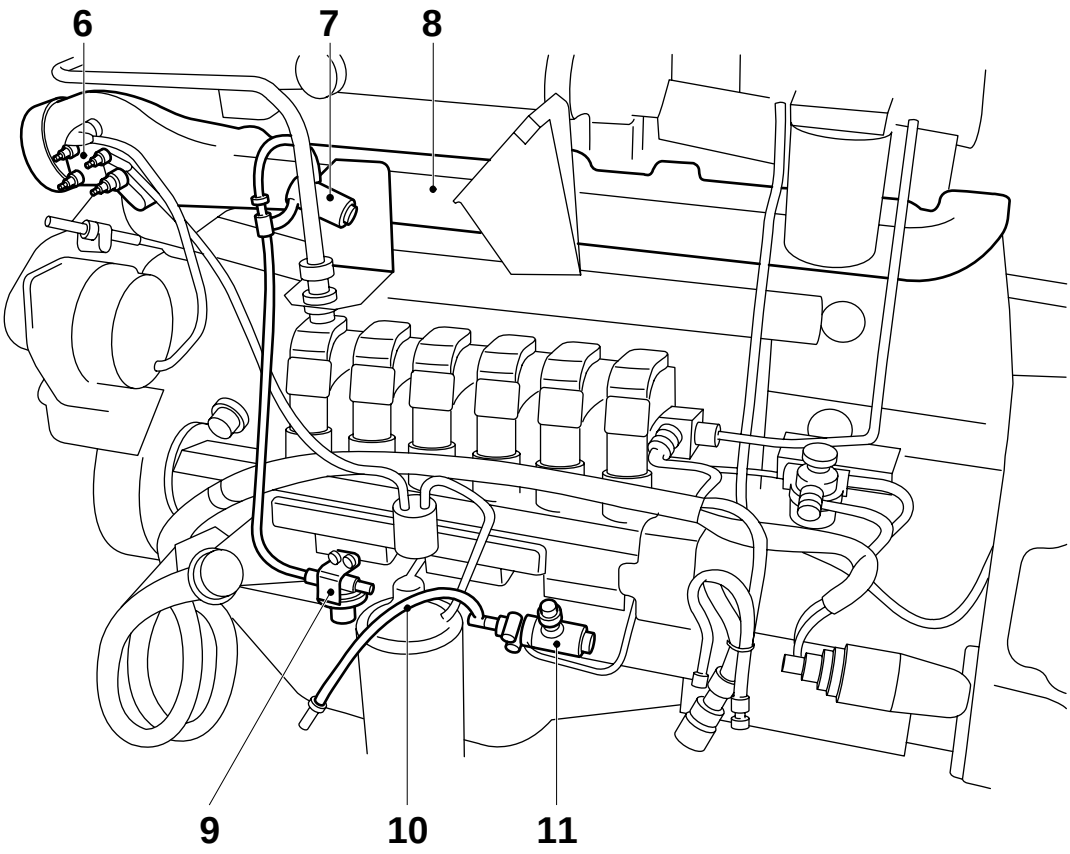
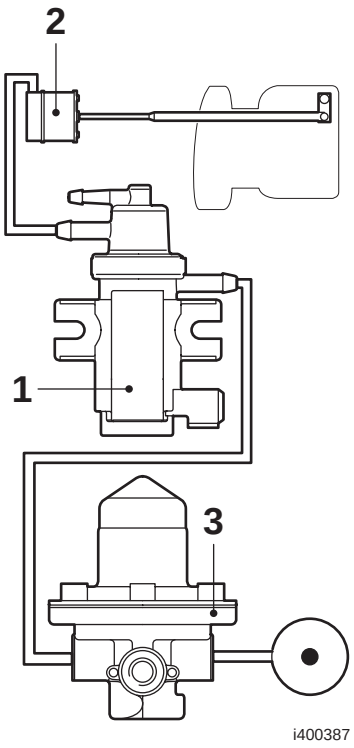
1. Inlet pipe
2. Wastegate diaphragm
3. Turbocharger
4. Exhaust bend with integrated butterfly valve
5. Wastegate diaphragm air pipe



6. Glow filaments
7. Electro-pneumatic boost pressure valve
8. Inlet manifold
9. Pressure-reducing valve
10. Supply line
11. Engine brake valve

2.2 DESCRIPTION OF TURBOCHARGER SYSTEM WITH WASTEGATE

Wastegate
To make the engine more responsive at lower engine speeds, a turbocharger is used that produces a better fill ratio at such speeds.
If no special provisions were made, the boost pressure yielded by such a turbocharger would be too high at maximum engine speeds. This is prevented by using a wastegate.
The boost pressure is measured by a sensor on the inlet manifold.
The boost pressure control valve (1), which - depending on the boost pressure measured - is activated by the electronic unit, operates the diaphragm of the wastegate (2) and the control rod connected to it, using air pressure. The air supply available via a pressure reducing valve (3) is used for activating the air pressure valve. The control rod operates a valve in the turbine housing.
The valve in the turbine housing is opened when the maximum allowable pressure has been reached. When the valve is opened, some of the exhaust gases will be discharged to the exhaust pipe rather than being used to propel the turbocharger's turbine wheel.

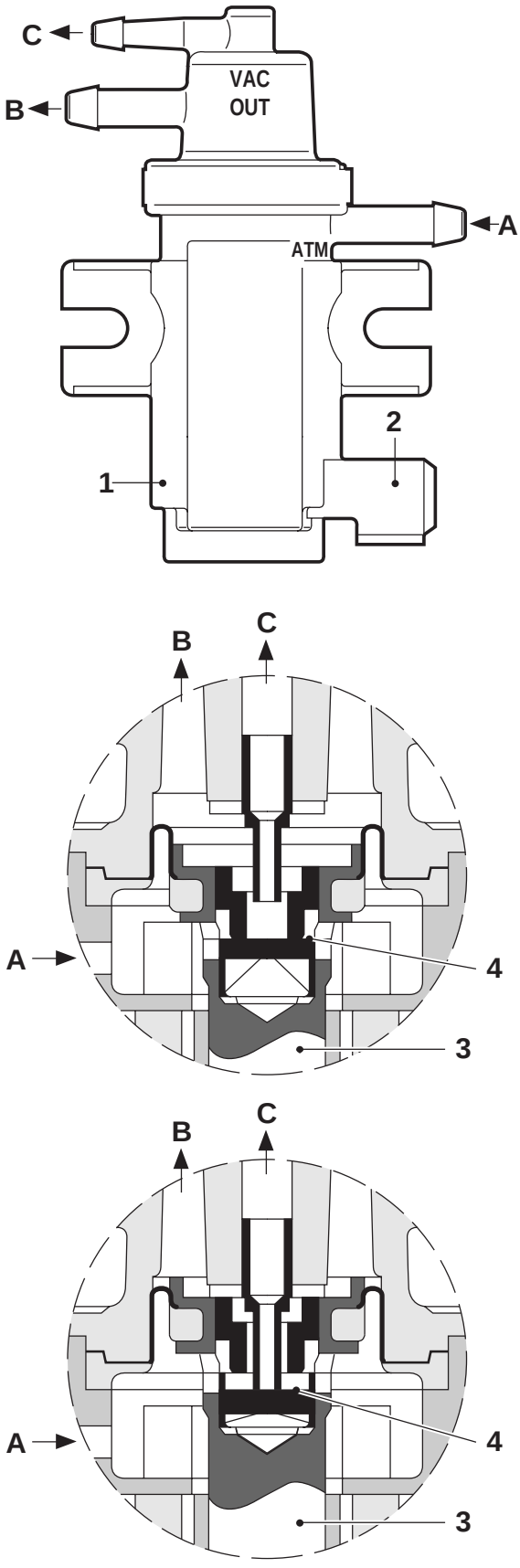


Compression housing by-pass
At higher boost pressures, the compressor of the turbocharger tends to allow this pressure to return to the inlet underpressure area. To prevent this, the compression housing of the turbocharger has been adapted.
This adaptation consists of bypass ducts and a stop plate.
Boost pressure attempting to return to the inlet area, will do so at the outer circumference of the compression housing.
Providing the compression housing with an air slot forces this pressure to flow through special air ducts on the outside until it is arrested by the stop plate.

Electro-pneumatic boost pressure valve
There are three connection points at the upper side of the electro-pneumatic boost pressure valve (1).
Point A (coding “ATM”) is connected to the air supply via a pressure reducing valve.
For the pressure at connection point A, see the main group “Technical data”.
Point B (coding “OUT”) is connected to the wastegate of the turbocharger.
Point C (coding “VAC”) is the air-bleed connection.
The electrical connection point (2) for activation of the magnetic valve is located at the bottom of the electro-pneumatic boost pressure valve (1).
This magnetic valve is activated proportionally, using a duty cycle.

Situation wastegate not activated
If the maximum boost pressure calculated by the electronic unit has not yet been reached, the electronic unit activates the magnetic valve (3) with a high duty cycle-value (current value).
This high duty cycle-value creates a powerful magnetic field.
The supply pressure at connection point A is also exerted under the diaphragm surface.
A pressure of approx. 0.8 bar under the diaphragm surface suffices to move the magnetic valve (3) upwards against the force of the magnetic field.

This forces valve (4) downwards, as a result of which the bleeding facility C is closed and there will be an interconnection between points A and B.
The pressure at the upper side of the magnetic valve (3) will now move the magnetic valve downwards again, which creates a state of balance.
So, in this situation, the supply pressure at the wastegate connection (point B) will always be approximately 0.8 bar lower than the reservoir pressure at connection point A, as a result of which the wastegate will not be activated.



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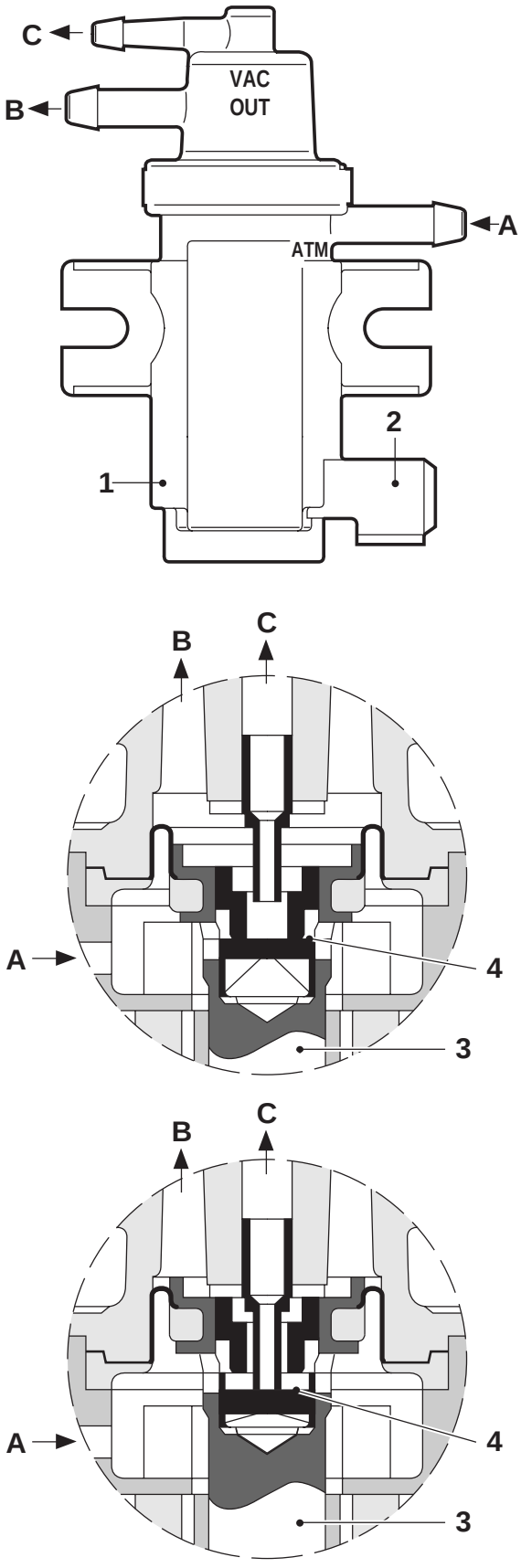
Situation wastegate activated
This is the situation in which the maximum boost pressure calculated by the electronic unit is achieved.
The electronic unit will now activate the magnetic valve (3) with a lower duty cycle-value (current value).
The supply pressure prevailing under the diaphragm surface can now move the magnetic valve (3) upwards against the force of the magnetic field.
This forces valve (4) downwards, as a result of which the bleeding facility C is closed and there will be an interconnection between points A and B.
The rise in pressure at connection point B will now cause the wastegate to be activated.

Once the boost pressure calculated has been reached. the duty cycle-value will again increase. This will again intensify the magnetic field.
The magnetic valve (3) will now again move downwards under the influence of the magnetic field strength and the pressure on the upper side of the magnetic valve.
The interconnection between A and B is closed and bleed facility C opened.
The pressure at connection point B will now drop, until a state of balance is again achieved. This allows accurate adjustment of the desired boost pressure.

Note:
If the electronic unit is unable to activate the electro-pneumatic boost pressure valve (for instance, due to an open circuit), the supply pressure from the pressure-reducing valve, which prevails under the diaphragm surface, will move the magnetic valve (3) upwards.
This creates a connection between the air supply at connection point A and the wastegate at connection point B.
The wastegate is now activated (opened), as a result of which the maximum boost pressure will not be reached.



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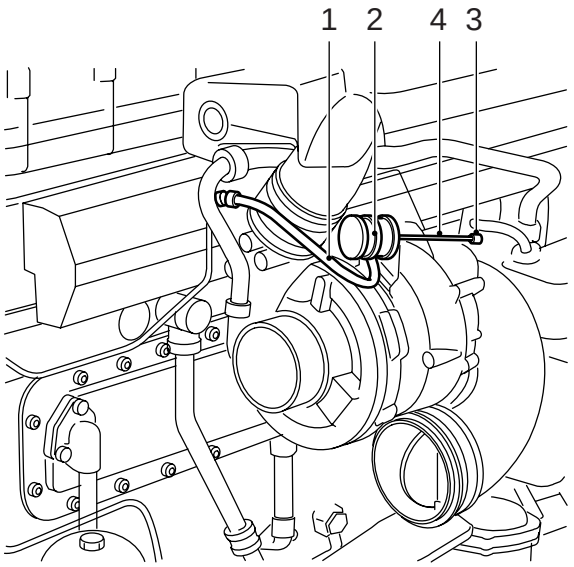
3. INSPECTION AND ADJUSTMENT

3.1 CHECKING AND ADJUSTING THE WASTEGATE TURBOCHARGER

1. Remove the heat shield from the turbocharger.
2. Remove the air supply connector (1) from the diaphragm housing (2).
3. Remove the retaining clip (3) and remove the control rod (4) from the wastegate lever.
4. **Note:**
   Since the air for the control of the wastegate is branched from the air supply, air will escape from the air supply via the pressure-reducing valve and the electro-pneumatic boost pressure valve when detaching the air connection.

   Using a pressure-reducing valve, apply the required pressure setting to the diaphragm housing connection, see main group “Technical data”.
5. Push the wastegate lever fully to the left to close the wastegate valve.
6. Adjust the length of the control rod (4), making sure it fits exactly on to the lever at the set pressure.
7. Check the wastegate setting at the specified pressure, see main group “Technical data”.
8. Install the retaining clip (3).



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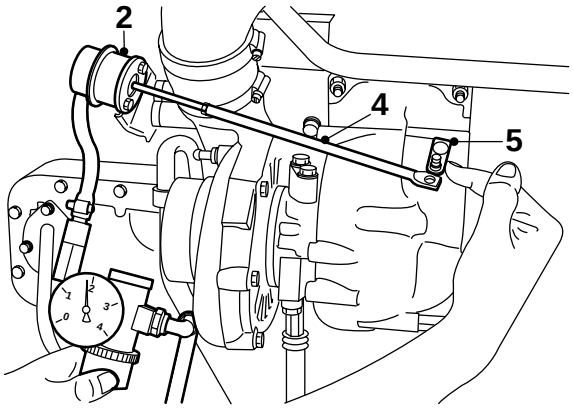

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3.2 INSPECTION OF EXHAUST BACK PRESSURE

Inspecting the exhaust back pressure

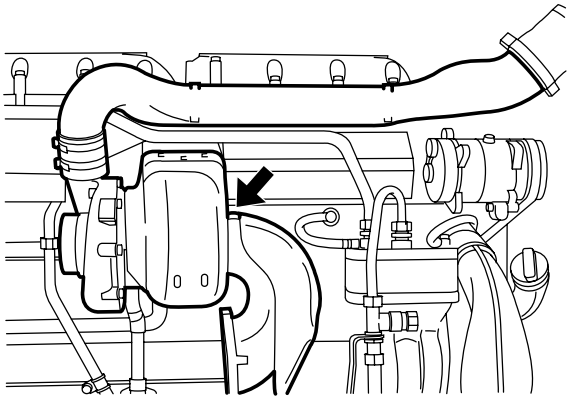
1. Remove the plug from the exhaust bend and install a suitable coupling with a pipe. The first part of the pipe must be made of metal, to withstand the high temperatures.

2. **Note:**
   Use an attenuated gauge to prevent excessive shaking of the gauge needle.

   Connect a pressure gauge to the pipe, with a range of at least 0.1 - 0.2 bar (10 - 20 kPa).

3. **Note:**
   The engine brake must not be used during measurements.
   This is done to protect the pressure gauge.

   Measure the exhaust back pressure at the maximum loaded engine speed and compare the measurement result with the specified value. See main group “Technical data”.



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3.3 INSPECTION AND PRESSURE-TESTING OF AIR INLET SYSTEM

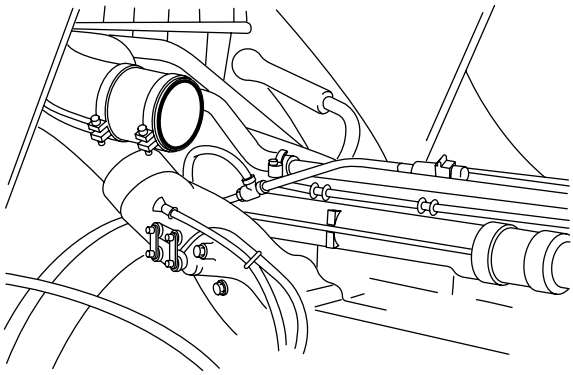
When pressure-testing the air-inlet system, the plugs may spring off if they are not properly secured.

In the air inlet system, check the condition and attachment of the air inlet channels/ flexible pipes.

In case of doubt as to the proper sealing of the air inlet system, indicated by the following:
- loss of power
- high fuel consumption
- unusual noises,

carry out a pressure test to check the air inlet system for leaks.

1. Remove the front engine encapsulation.
2. Remove the air inlet hose between the intercooler and the inlet manifold.
3. Install the inlet hose with the special tool (DAF no. 0694831) on the intercooler, twisting it slightly.
4. Remove the air inlet pipe between the air cleaner housing and the turbocharger intake port.
5. Install the special tools (DAF no. 1329310 and DAF no. 1329311) on the turbocharger intake port.



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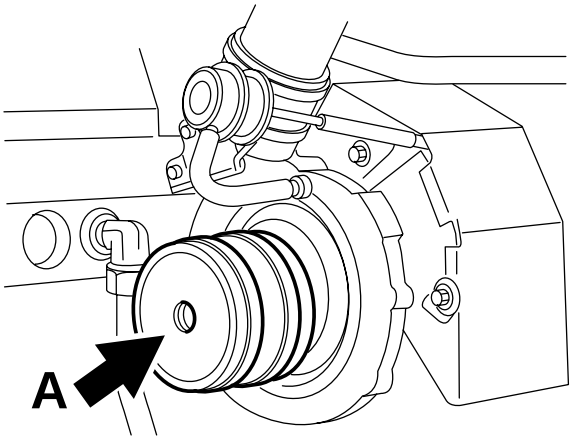
6. Connect an air hose with reducing valve to the plug (A), and charge the system to approx. 1 bar.
7. Use soapy water to check the complete inlet system for air leakage. Also check whether the pressure gauge of the reducer valve moves down.



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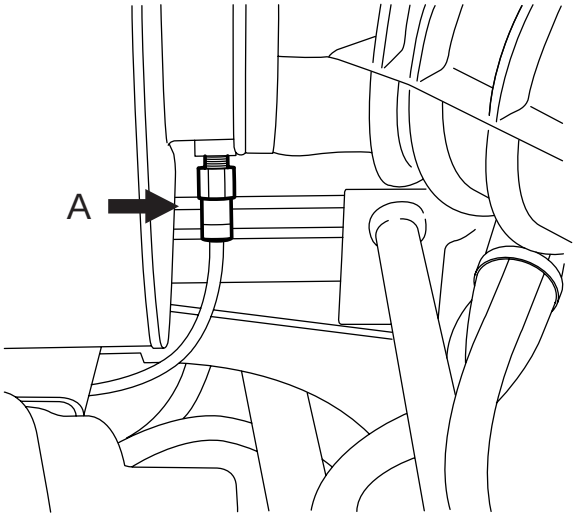
3.4 INSPECTION OF INLET UNDERPRESSURE

1. Remove the connection of the underpressure sensor (A) from the inlet pipe between the air cleaner housing and the turbocharger.
2. Connect a pressure gauge with a maximum rating of –100 mbar (–10 kPa) to the connection of the underpressure sensor.
3. Measure the inlet underpressure at the maximum loaded engine speed and compare the measurement result with the specified value. See main group “Technical data”.



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3.5 INSPECTION OF BOOST PRESSURE

To obtain a better indication of where the problem occurs, the gallery pressure, the inlet underpressure and the exhaust back pressure can be measured at the same time as the boost pressure.

Drive the same route each time to obtain as good a picture as possible.

Turbocharger with wastegate
When you measure the boost pressure curve of a vehicle fitted with a turbocharger with wastegate, the air hose between the electro-pneumatic boost pressure valve and the diaphragm must not be disconnected.

1. DAVIE can be used for measuring the boost pressure.
2. The weight of the vehicle should approximate the maximum combination weight.

3. Run the engine at operating temperature (drive for at least 15 minutes with a loaded vehicle).
4. Select the highest gear but one.
5. In this gear, apply full throttle from 800 rpm.
6. Note, from 900 rpm, the boost pressure per 100 rpm.
7. Perform this measurement at least three times and take the mean values.
8. Plot a graph on the test sheet with the mean values found.

   Note:
   The shape of the curve is important. The exact value is of less importance.

Checking procedure following plotting of a boost pressure curve

- Check the fuel system for the presence of air.
- Replace/clean the air filter element.
- Check the setting of the wastegate on the turbocharger (if present).
- Check the exhaust brake butterfly valve for correct operation.
- Check the charge cooler exterior for dirt deposits.
- Visually check the low-pressure fuel pipes for leaks and correct installation.
- Clean the water separator (if fitted).
- Replace the fuel filter.
- Clean the fuel coarse filter.

- Check the suction pipe of the tank for clogging by large pieces of foreign matter.
- Check the fuel tank for contamination. Clean the tank with a steam cleaner, if necessary.
- Check the air inlet system for any leaks.
- Check the exhaust system for any leaks.
- Check the exhaust system for blockages by measuring the exhaust back pressure.
- Check the turbocharger wheels on the compressor and turbine side for damage and for deposits of salt or any other contaminants.
- Check the valve and DEB play.
- Check the injection lines for damage.
- Check the fuel pressure on the on the low-pressure side.
- Check whether components of the right type have been fitted (turbocharger, injectors etc.).
- Check the opening pressure of the injectors.
- Clean the nozzle openings using calibrated injector needles (DAF no. 1329371).

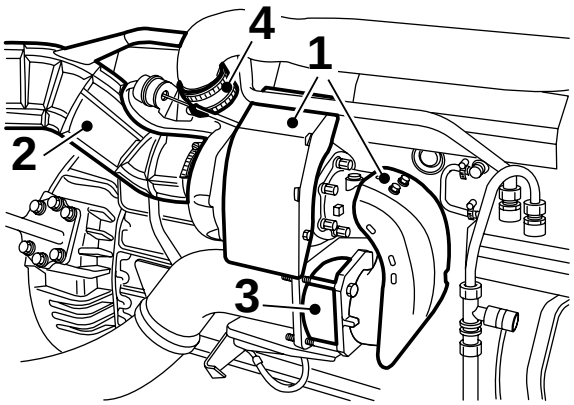
4. REMOVAL AND INSTALLATION

4.1 REMOVAL AND INSTALLATION OF TURBOCHARGER

If the turbocharger to be replaced was damaged to such an extent that parts of the turbocharger are missing or that lubricating oil has entered the inlet system, the inlet and exhaust systems must be cleaned and inspected thoroughly in order to prevent serious damage to the engine.

Removing the turbocharger

1. Remove the heat shields (1) from the turbocharger.
2. Remove the air inlet hose (2) between the turbocharger and the air filter.
3. Remove the exhaust brake (3).
4. Disconnect the connector pipe (4) from the turbocharger and the air inlet pipe to the intercooler.
5. Remove the turbocharger lubricating pipes. Plug the openings.
6. Remove the fixing nuts from the turbocharger.
7. Remove the turbocharger from the exhaust manifold.



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Installing the turbocharger

1. Before installing the turbocharger, check the following:
   - turbocharger shaft must rotate freely;
   - turbocharger shaft must not be out of true;
   - turbocharger shaft must have little radial clearance.

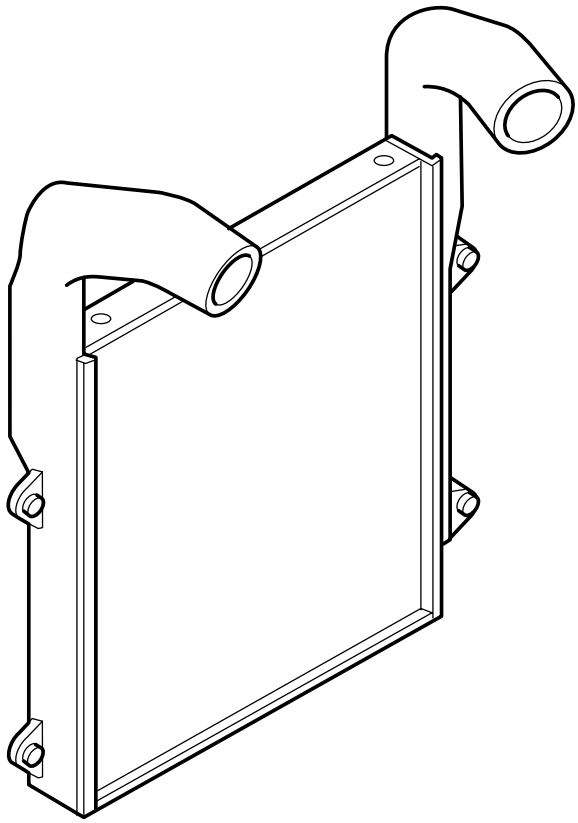
   If applicable:
   - movement of the wastegate.
2. Clean the sealing faces.
3. Apply a layer of Copaslip to the exhaust manifold studs.
4. Always use new gaskets during installation.
5. Install the turbocharger. Install the turbocharger, if necessary turning the two halves of the housing so that the oil and air pipes can be connected free of stress.
6. Install the oil discharge pipe.
7. Spray clean engine oil into the oil supply of the turbocharger, and install the oil supply pipe.
8. Install the connector pipe from the turbocharger and the air inlet pipe to the intercooler.
9. Install the exhaust brake.
10. Install the air inlet hose between the turbocharger and the air filter.
11. Install the heat shields for the turbocharger. Tighten the fixing bolts to the specified tightening torque. See main group “Technical data”.
12. **Always** check the setting of the wastegate, see chapter “Inspection and adjustment”.

4.2 REMOVAL AND INSTALLATION OF INTERCOOLER

Note:
The removal and installation procedure of the intercooler allows for the presence of an airconditioning unit.
If such a unit is not present, the sections concerned can be skipped.

Removing the intercooler

1. Disconnect the earth clamp from the battery pole.
2. Remove the lower grille.
3. Remove the front engine encapsulation.
4. Remove the engine encapsulation under the cab.
5. Disconnect the two coolant pipes and the air-conditioning pipe from the pipe strip at the front of the intercooler.
6. Remove the pipe strip.
7. Remove the oil dip stick from the intercooler and put it aside.
8. Remove the radiator expansion reservoir and put it aside.
9. Remove the fixing bolts from the air-conditioning condenser and pull the condenser forwards.
10. Disconnect the other air-conditioning pipes from the intercooler.
11. Remove the wire mesh underneath the intercooler.
12. Remove the air-conditioning dryer underneath the intercooler.
13. Remove the left-hand connector pipe from the inlet manifold to the intercooler.



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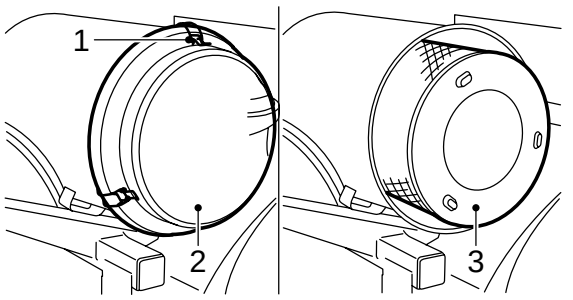
14. Remove the right-hand connector pipe from the inlet pipe to the intercooler.
15. Remove the air-conditioning compressor unit and move it, together with the hoses, to the front of the intercooler.
16. Remove the fixing bolts from the intercooler.
17. Move the intercooler a little to the right to remove the fixing bolt of the oil filler pipe.
18. Slide the oil filler pipe to the right and put it aside.
19. Remove the fixing rod from the radiator to the engine lifting eye.
20. Carefully pull the intercooler up between the radiator and the condenser.

Installing the intercooler

1. Carefully lower the intercooler between the radiator and the condenser.
2. Slide the oil filler pipe onto the radiator and install the fixing bolt.
3. Place the intercooler in its position and hand-tighten with two fixing bolts.
4. Install the fixing rod from the radiator to the engine lifting eye.
5. Install the air-conditioning compressor with its pipes.
6. Install the air-conditioning dryer underneath the intercooler.
7. Install the wire mesh underneath the intercooler.
8. Install the air-conditioning condenser.
9. Install the other air-conditioning pipes.

10. Install the other fixing bolts of the intercooler.
11. Insert the oil dip stick.
12. Install the pipe strip.
13. Install the two coolant pipes and the air-conditioning pipe onto the pipe strip at the front of the intercooler.
14. Install the connector pipes between manifolds and intercooler. Tighten the fixing bolts to the specified tightening torque. See main group “Technical data”.
15. Install the expansion reservoir.
16. Install the engine encapsulation under the cab.
17. Install the front engine encapsulation.
18. Install the lower grille.
19. Connect the earth clamp to the battery.

4.3 REMOVAL AND INSTALLATION OF AIR CLEANER ELEMENT



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Removing the air cleaner element

1. Remove the clamping bracket connectors (1) from the air-filter cover (2).
2. Remove the air-filter cover.
3. Remove the air-filter element (3).
4. Check the air cleaner element for damage. If the air-filter element or its seals are damaged, the air-filter element must be replaced.
5. Clean the inside of the air cleaner housing and the air cleaner cover.
6. If required, clean the air-filter element, see chapter “Cleaning”.

Installing the air cleaner element

1. Install the air-filter element in the air-filter housing.
2. Install the air-filter cover, making sure the arrow on the cover points upwards.

   Note:
   This position is important if a rubber sealing valve has been installed on the air-filter cover.
3. Install the clamping brackets.

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5. CLEANING

5.1 CLEANING THE RADIATOR AND INTERCOOLER

Inhalation of dust may have serious consequences for your health. Take the necessary precautions, such as wearing goggles and a face mask.

Cleaning the protective screen

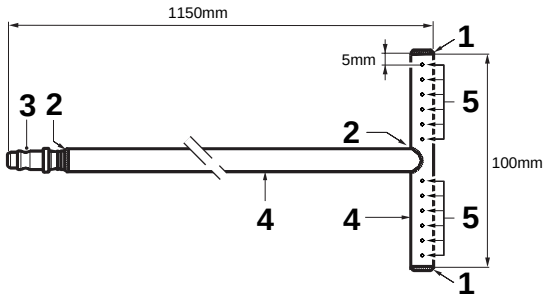
1. Remove the lower grille.
2. Unscrew the protective screen attachment bolts.
3. Remove the protective screen.
4. Clean the protective screen with a hard brush, and blow-clean it with compressed air.

Cleaning the radiator and intercooler elements

With the aid of a simple tool, the radiator and the intercooler can be blow-cleaned.
This tool can be made in your own workshop. It cannot be obtained from DAF.

Key to drawing:

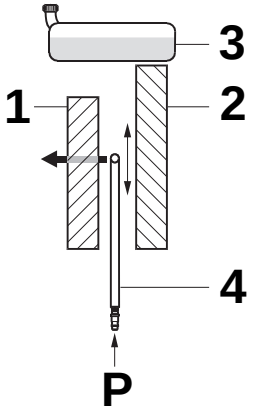
1. Solder up
2. Solder
3. Quick-release coupling for air pipe
4. Steel pipe, ∅ 10 mm
5. 6 × ∅ 1.5 mm diameter holes, with a centre-to-centre distance between the holes of 7 mm, drilled on one side.



1. **Note:**
   Make sure not to damage the intercooler and radiator element when fitting the radiator cleaner.

   Insert the radiator cleaner (4) between the intercooler (1) and radiator (2), from the bottom upwards, with the air holes facing the intercooler (1).

2. Apply air pressure to the radiator cleaner (4) and continue blow-cleaning the intercooler (1) until the release of dirt has stopped.



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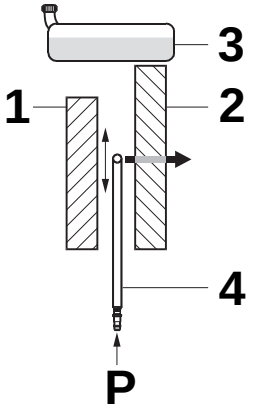
3. Turn the radiator cleaner over, turning the holes towards the radiator (2), and blow-clean the radiator (2).



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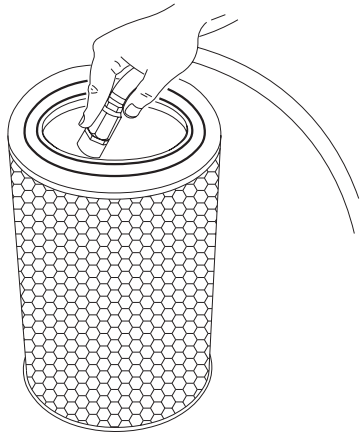
5.2 CLEANING THE AIR CLEANER ELEMENT

Inhalation of dust may have serious consequences for your health. Take the necessary precautions, such as wearing goggles and a face mask.

1. Remove the air cleaner element, see chapter “Removal and installation”.
2. Check the air cleaner element for damage. If the air-filter element or its seals are damaged, the air-filter element must be replaced.
3. Knock on the air cleaner element to remove any dirt.
4. Blow-clean the air-filter element by blowing pressurised air through from the inside, using a maximum pressure of approx. 1.5 bar.
5. Install the air cleaner element. See “Removal and installation”.



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CONTENTS

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1. SAFETY INSTRUCTIONS

Do not run the engine in an enclosed or unventilated area.
Make sure exhaust fumes are properly extracted.

Maintain a safe distance from rotating and/or moving components.

Various sorts of oil and other lubricants used on the vehicle may constitute a health hazard. This also applies to engine coolant, windscreen washer fluid, refrigerant in air-conditioning systems, battery acid and diesel fuel.
So avoid inhaling and direct contact.

Exhaust gases contain carbon monoxide. Carbon monoxide is a deadly, colourless and odourless gas, which, when inhaled, deprives the body of oxygen, leading to asphyxiation. Serious carbon monoxide poisoning may result in brain damage or death.

It is recommended to always disconnect the battery's earth connection during repair or maintenance activities for which the power supply is not required.

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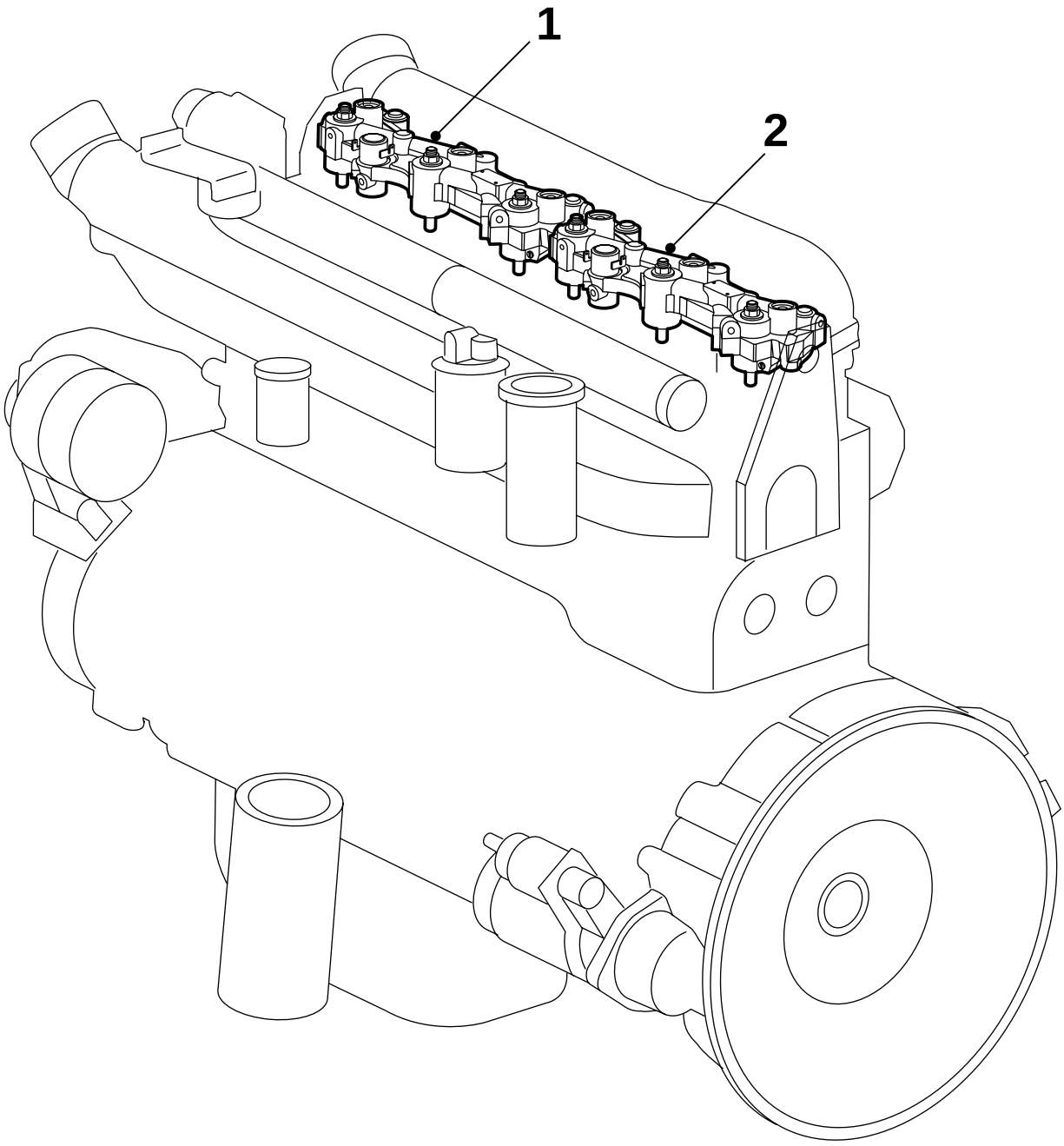
2. GENERAL

2.1 LOCATION OF DEB COMPONENTS



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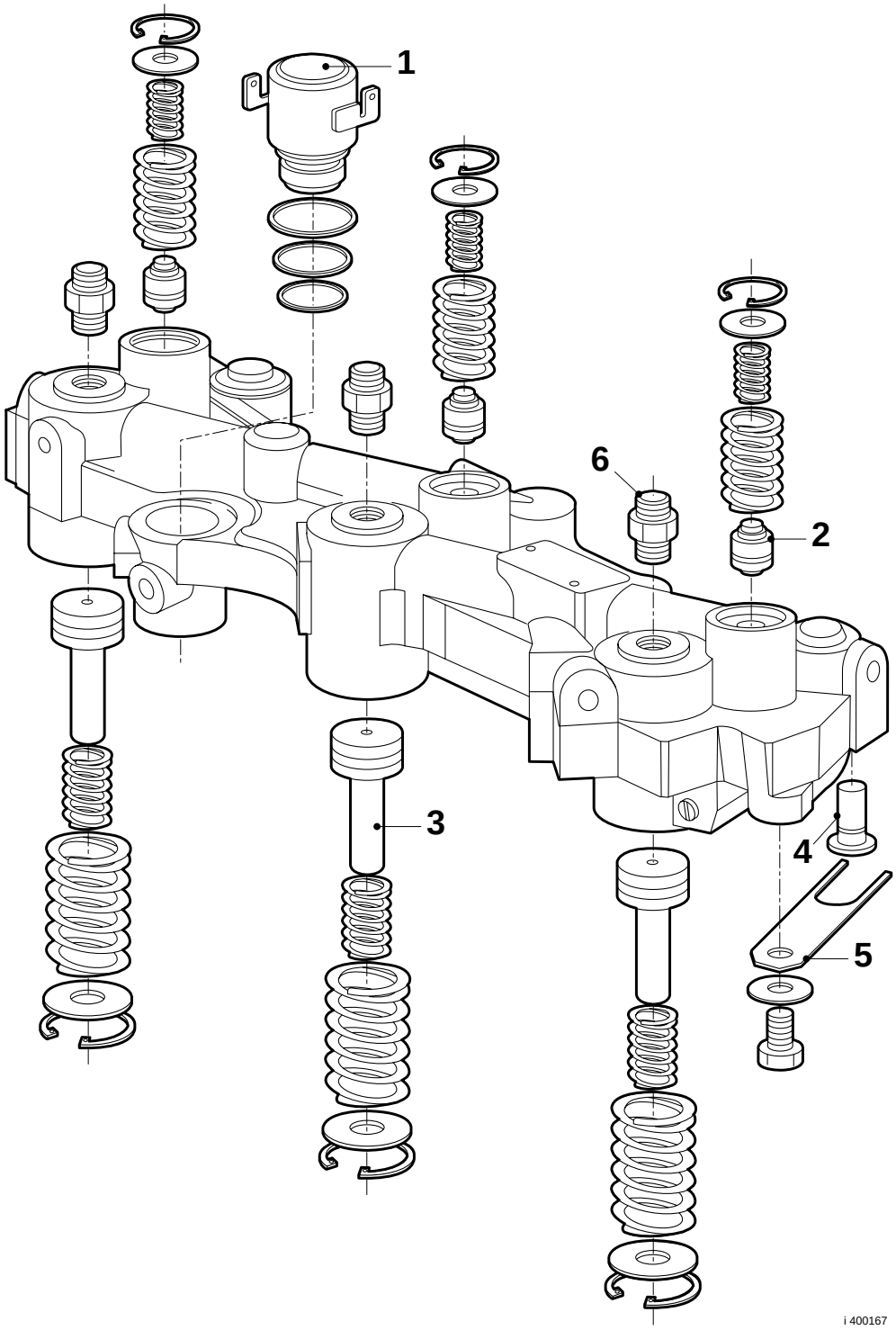
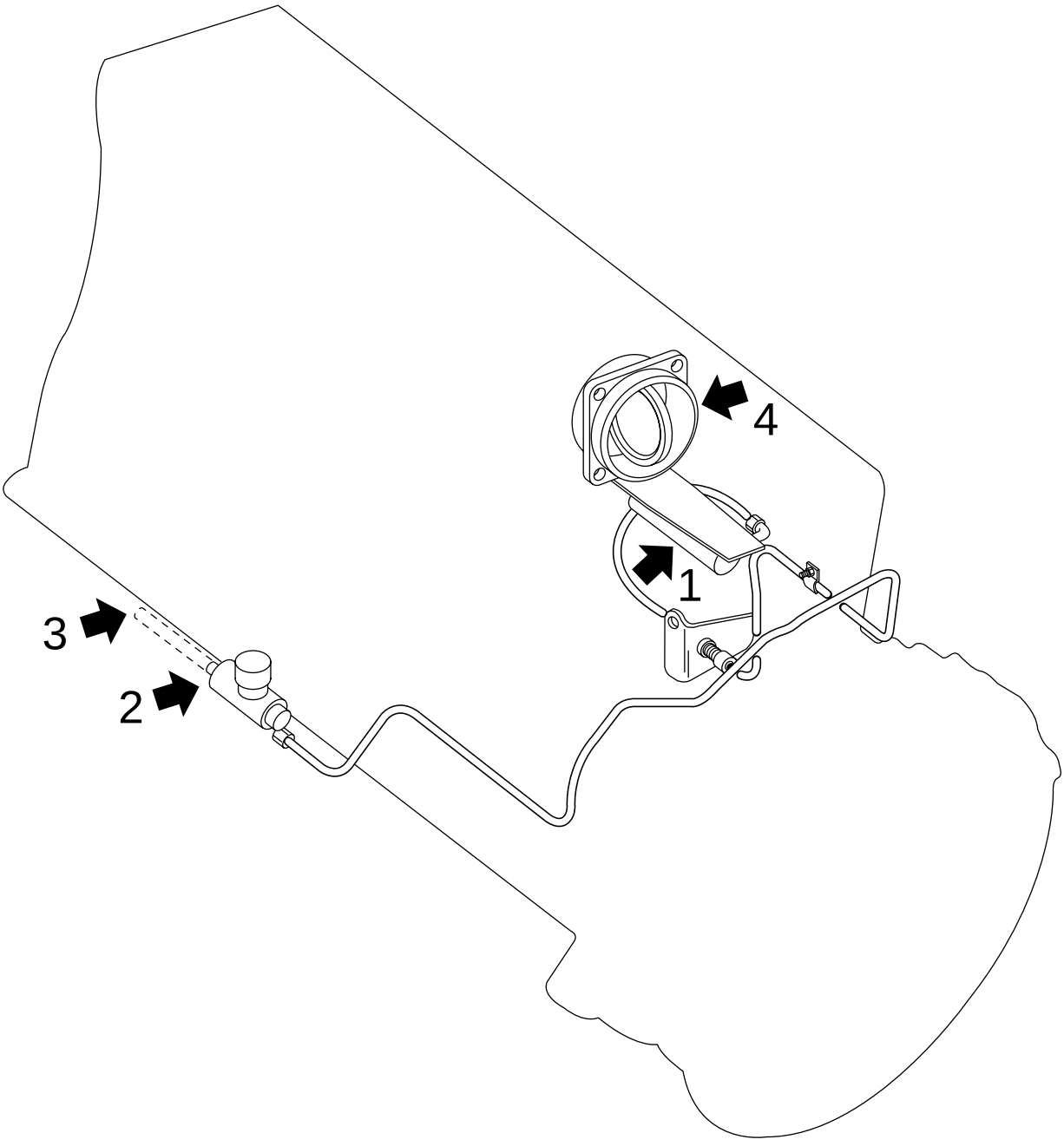
1. DEB housing, cylinders 1 - 2 - 3
2. DEB housing, cylinders 4 - 5 - 6

2.2 OVERVIEW DRAWING DEB



1. Magnetic valve
2. Control valve
3. Operating piston
4. Main piston
5. Spring plate
6. Set screw

2.3 LOCATION OF EXHAUST BRAKE COMPONENTS



1. Butterfly valve operating cylinder
2. Engine stop valve
3. Supply pressure
4. Butterfly valve housing

2.4 GENERAL DESCRIPTION OF ENGINE BRAKE SYSTEM

The collective term “engine brake” covers the exhaust brake or butterfly valve, and the DAF Engine Brake.

The introduction of the DAF XF 12.6 litre engine also marks the introduction of a new type of engine brake for DAF, which is also used on the XE engines.
This is the DAF Engine Brake, or DEB for short.

Every XE engine has a factory-fitted exhaust brake.
At customer’s request, the DEB can be installed at the factory or at a later date.

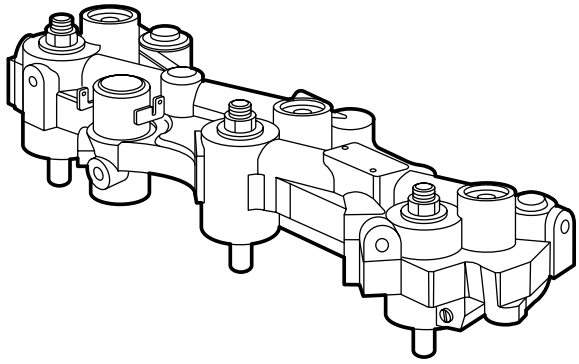
If the driver activates the engine brake by means of the engine brake control switch on the cab floor, both the exhaust brake and the DEB are engaged. Therefore, the DEB always works in conjunction with the exhaust brake.

As the CTE-3 checks the activation of the engine brake, it will disengage the engine brake below a certain engine speed (see CTE-3 systems manual).

2.5 DESCRIPTION OF DEB SYSTEM

The DEB consists of two different housings, each cylinder head having its own DEB housing. Each housing contains various valves, pistons, and a magnetic valve.

When the DEB is activated, one exhaust valve will be opened hydraulically at the end of the compression stroke. This allows compressed air to escape to the exhaust system.
The engine now functions as a compressor, supplying brake power to the vehicle.



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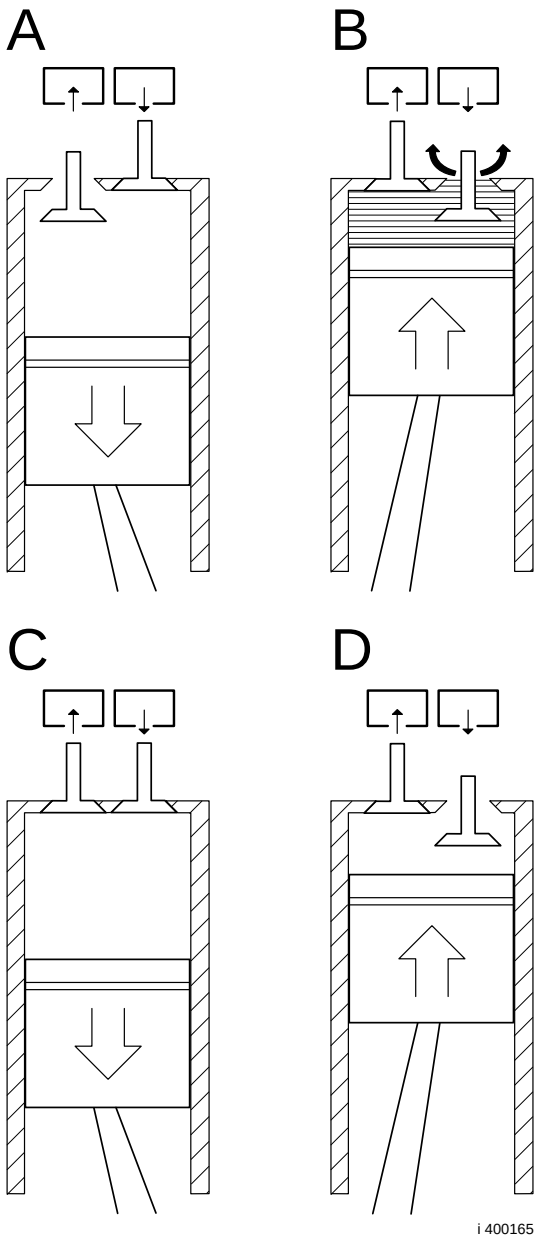
Position (A) Induction stroke
The piston moves down and the cylinder is filled with clean air.

Position (B) Compression stroke
The piston moves up and compresses the air in the cylinder, creating a reactionary force.
At the end of this stroke, one exhaust valve is opened briefly. The compressed air can now escape to the exhaust system.
If the DEB has been activated, no fuel is injected at the end of the compression stroke and hence no combustion takes place.

Position (C) Power stroke
The piston moves down and the exhaust valve closes.

Position (D) Exhaust stroke
The piston moves up, as during a normal exhaust stroke.



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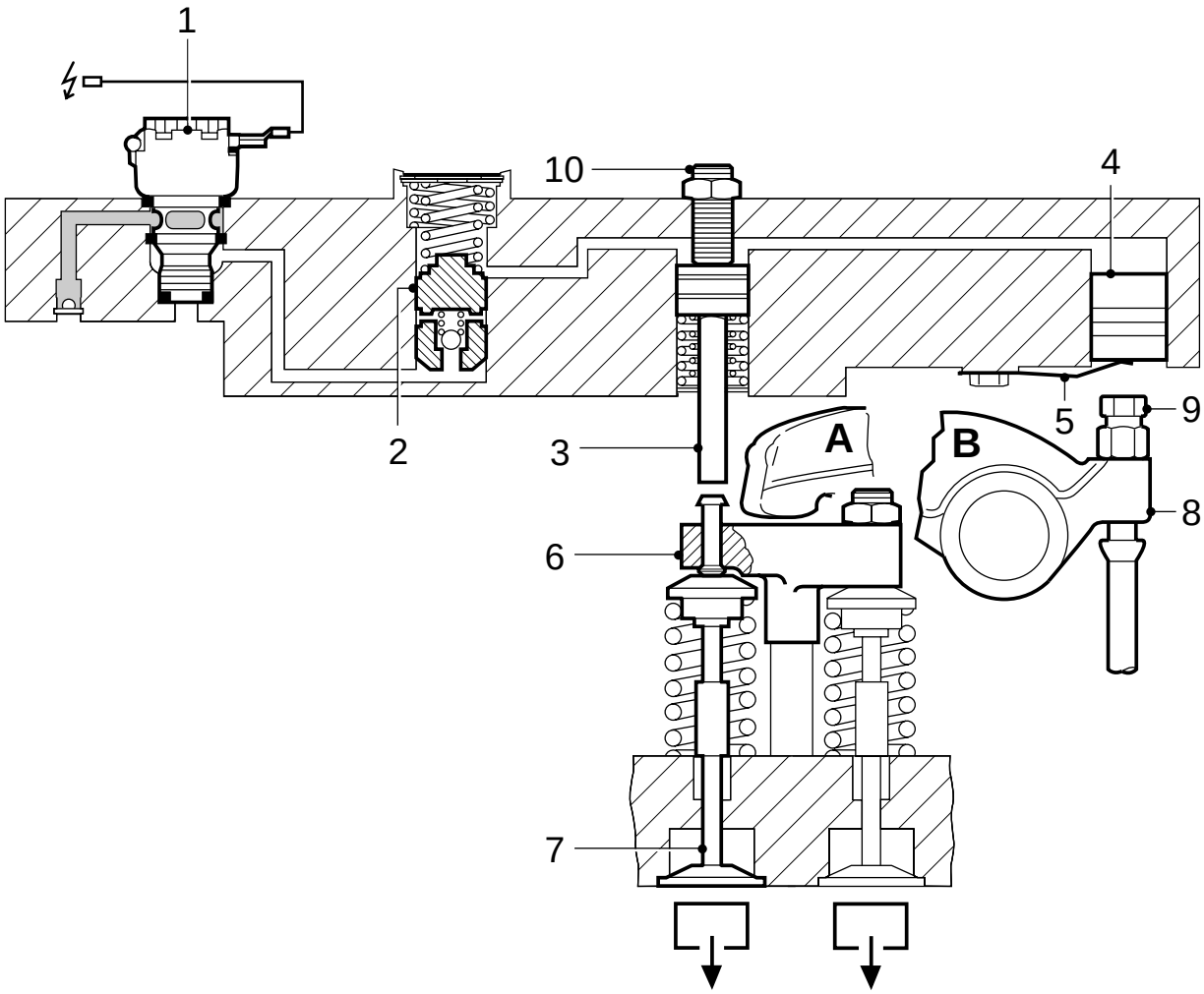
Operation of the hydraulic DEB

DEB switched off

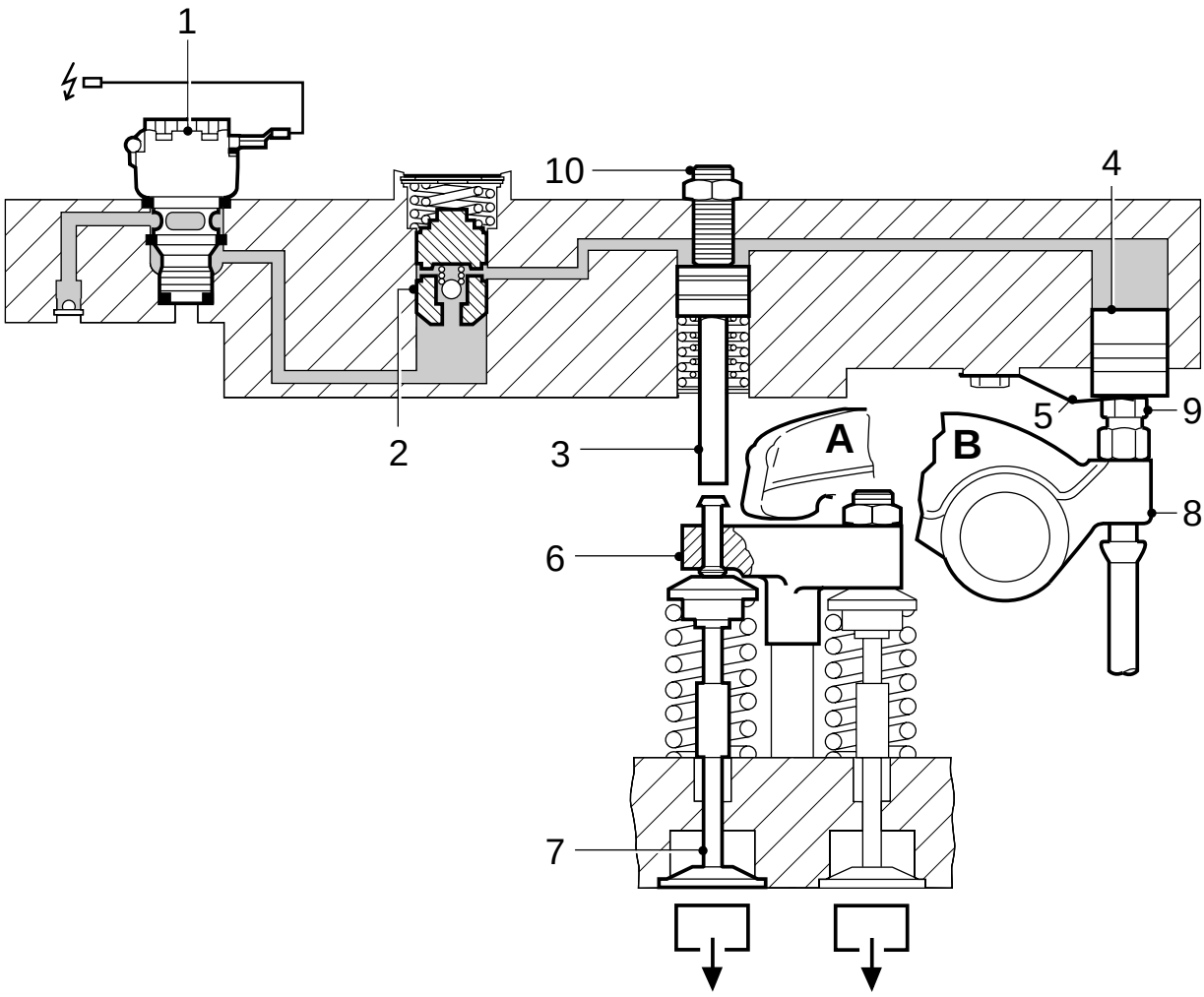


1. Magnetic valve
2. Control valve
3. Operating piston
4. Main piston
5. Spring plate
6. Bridge
7. Exhaust valve
8. Exhaust valve rocker
9. Valve clearance set screw
10. DEB set screw

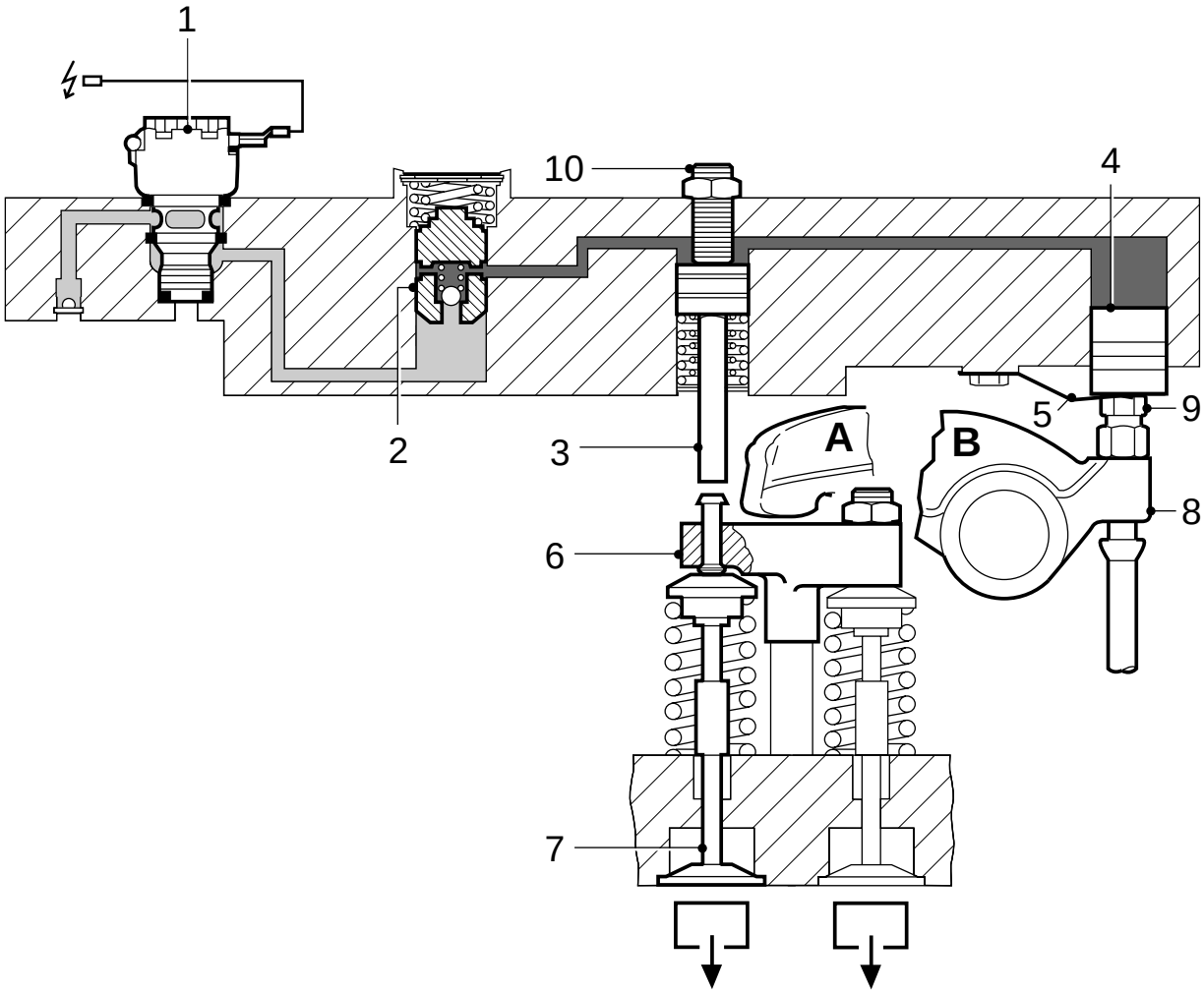
Note:
Rockers A and B are not one and the same rocker (see “Hydraulic control of exhaust valves”).
A. Exhaust valve rocker
B. Exhaust valve rocker

The magnetic valve (1) is not activated.
Lubricating oil cannot pass to the hydraulic section of the DEB.
In addition, a spring plate (5) ensures that the main piston (4) remains in the top position.

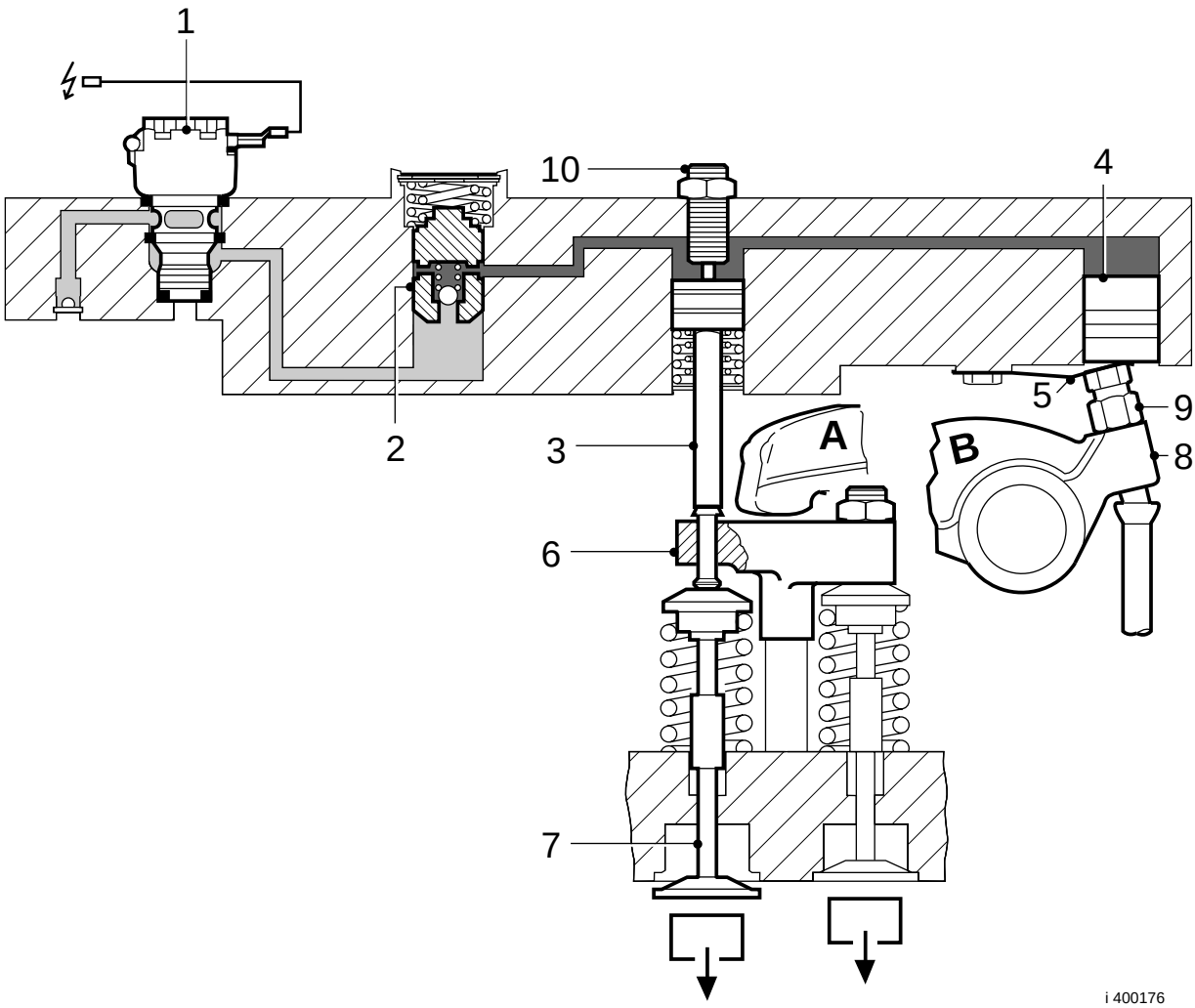
DEB switched on



The magnetic valve (1) is activated. Lubricating oil can pass to the hydraulic section of the DEB. The pressure of the lubricating oil, at least 1.5 bar, moves the control valve (2) against the spring pressure and lifts the ball from its seat. The high-pressure area of the DEB is now filled with lubricating oil.
The oil causes the main piston (4) to move down, until it rests on the set screw (9) of the rocker (8).

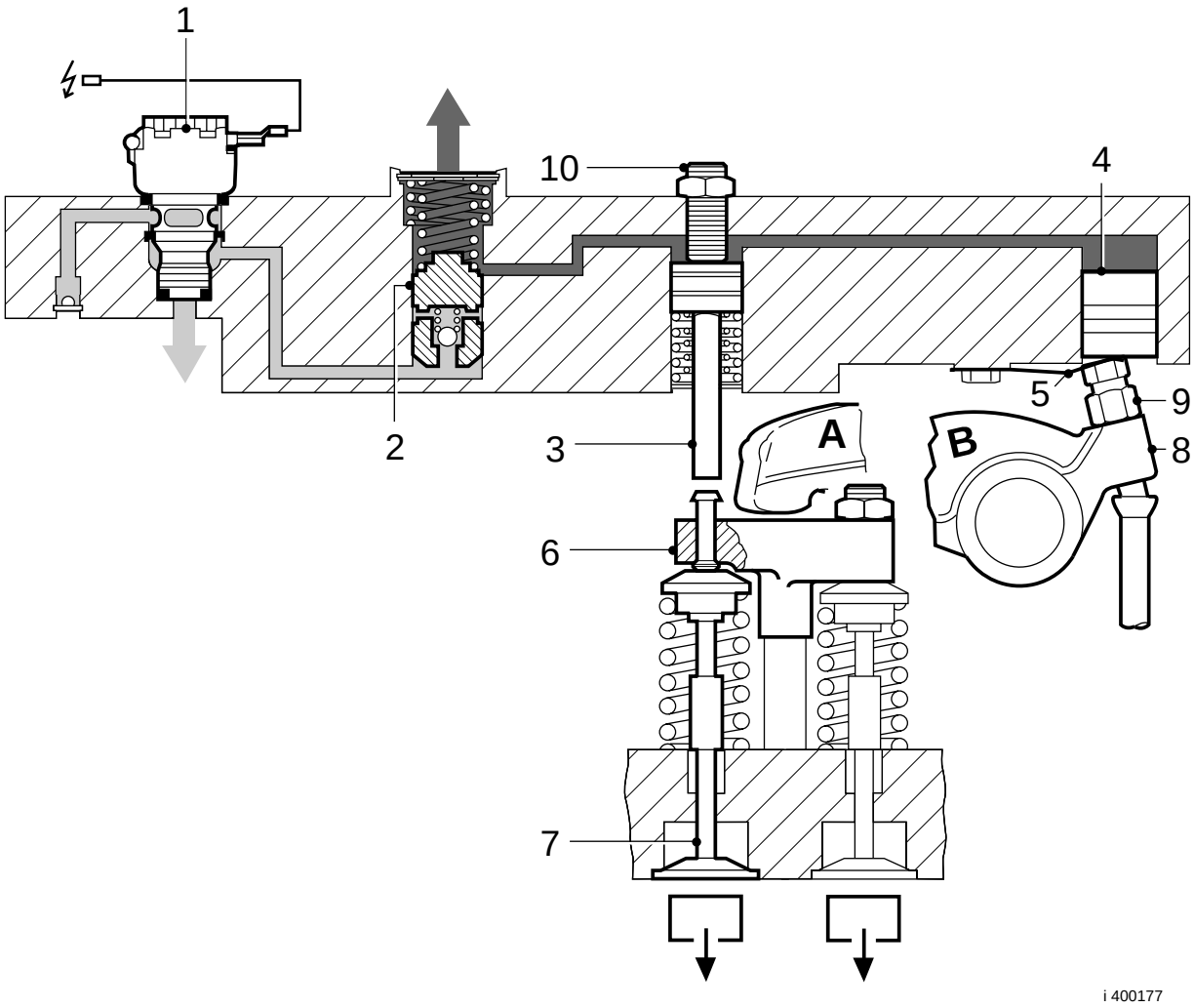


During the next upward movement of the rocker (8), the main piston (4) will be moved upwards. The main piston (4) begins to build up pressure, causing the ball in the control valve (2) to close off the oil supply.



When the main piston (4) continues to move up, this movement is transferred hydraulically to the operating piston (3).
The operating piston (3) moves downwards against the spring pressure, opening one exhaust valve.
In the case of loss of oil during operation, this will automatically be compensated for by the control valve (2).

Switching off the DEB



The magnetic valve (1) is no longer activated.
The spring pressure moves the control valve (2) downwards, as the oil pressure under the control valve (2) can flow back into the engine through a hole in the magnetic valve (1).
The oil from the high-pressure area of the DEB can now escape through a cleared opening above the control valve (2).
This is effected by the main piston (4) being moved up by the rocker.
The spring plate (5) holds the main piston (4) in its top position.

Hydraulic control of the exhaust valves
To open an exhaust valve hydraulically at the end of a compression stroke, optimal use is made of the valve diagram.
This means that the DEB uses an exhaust valve rocker of one cylinder to open an exhaust valve for another cylinder.

Cylinders 1, 2 and 3
Exhaust valve rocker of cylinder 1 hydraulically opens the exhaust valve of cylinder 3

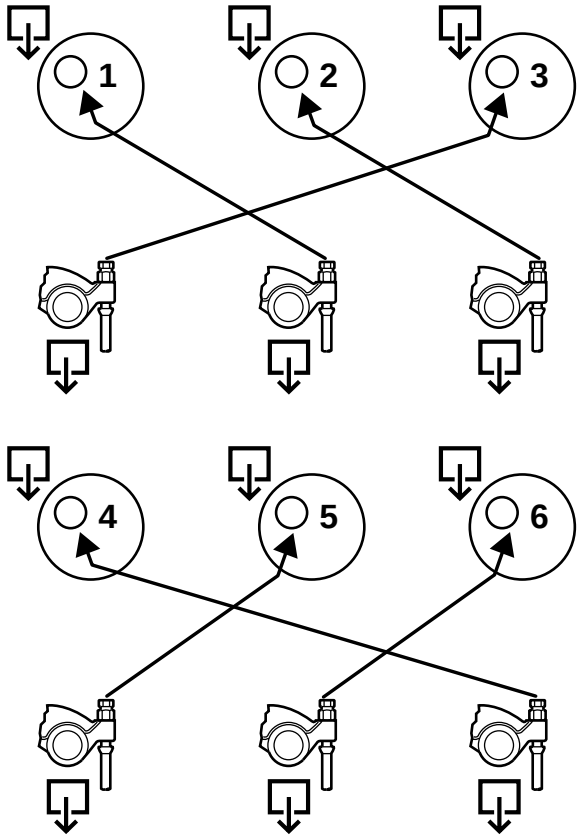
Exhaust valve rocker of cylinder 2 hydraulically opens the exhaust valve of cylinder 1

Exhaust valve rocker of cylinder 3 hydraulically opens the exhaust valve of cylinder 2

Cylinders 4, 5 and 6
Exhaust valve rocker of cylinder 4 hydraulically opens the exhaust valve of cylinder 5

Exhaust valve rocker of cylinder 5 hydraulically opens the exhaust valve of cylinder 6

Exhaust valve rocker of cylinder 6 hydraulically opens the exhaust valve of cylinder 4



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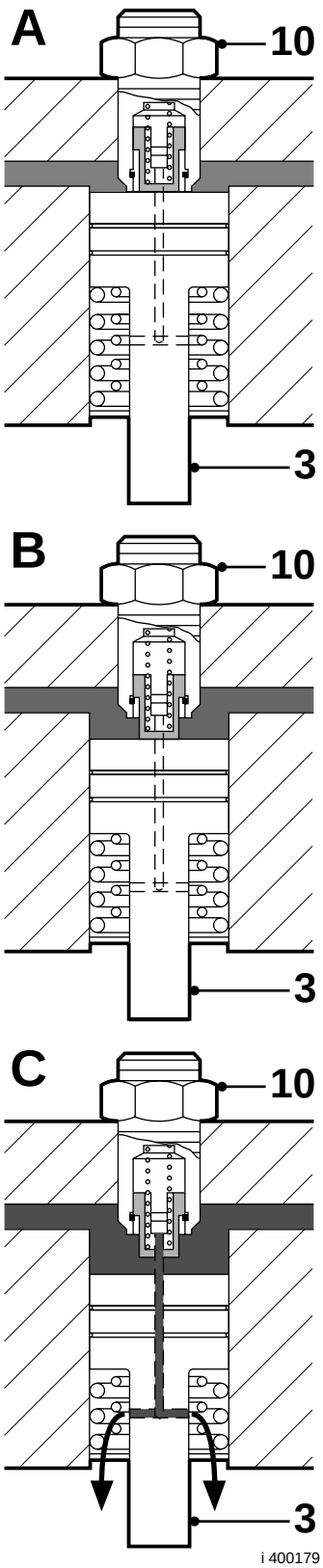
Preventing the exhaust valve from opening too far
Inside the set screw (10) is a spring-loaded pin. This pin projects approx. 2.7 mm from the set screw (10).
The operating piston (3) has a hole which is closed by the pin in the set screw (10).
If the operating piston (3) is hydraulically moved too far down, the hole in the operating piston (3) will no longer be closed. Oil in the high-pressure area escapes via the hole in the operating piston (3), preventing the exhaust valve from opening any further.

Position A:
Operating piston inactive.

Position B:
Operating piston during regular operation.

Position C:
Operating piston hydraulically opened too far, oil pressure is discharged via the operating piston.



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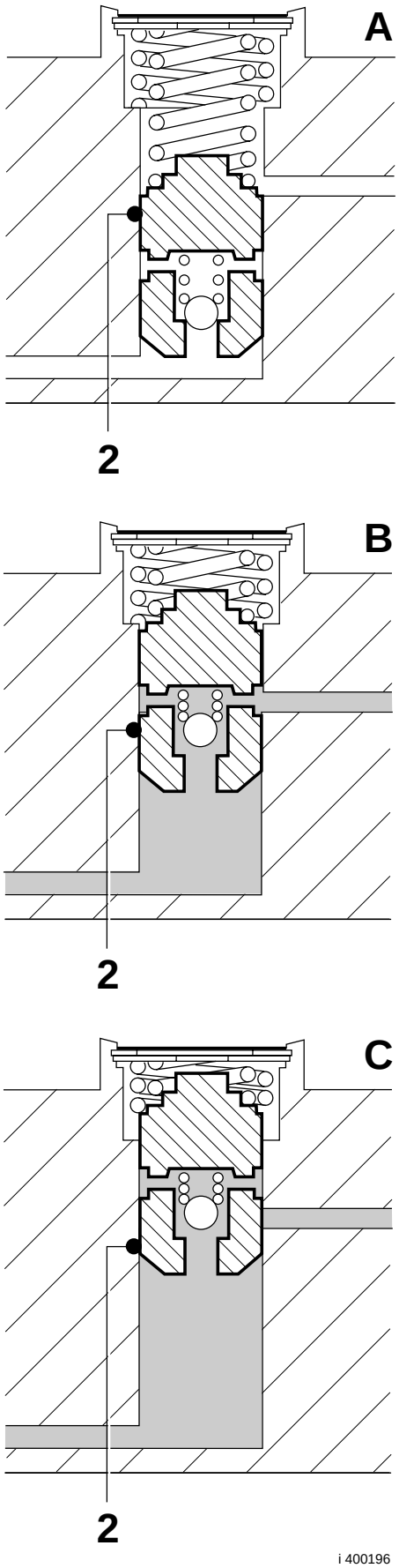
Protection against excess lubricating-oil pressure
There are 2 springs above the control valve.
When the DEB is switched on, the control valve will be moved upwards by the engine oil pressure against the direction of the pressure of the inner spring.
This clears the way for the lubricating oil to pass to the high-pressure area of the DEB.
If the lubricating-oil pressure in the engine is too high (≥ 8 bar), the control valve will be moved upwards against the pressure of both springs.
The control valve will move up further than usual, preventing the route to the high-pressure area of the DEB from being cleared.
The DEB will not function in this case.

Note:
A pressure in excess of 8 bar may result from:
- cold lubricating oil
- defective lubricating-oil pressure-relief valve.

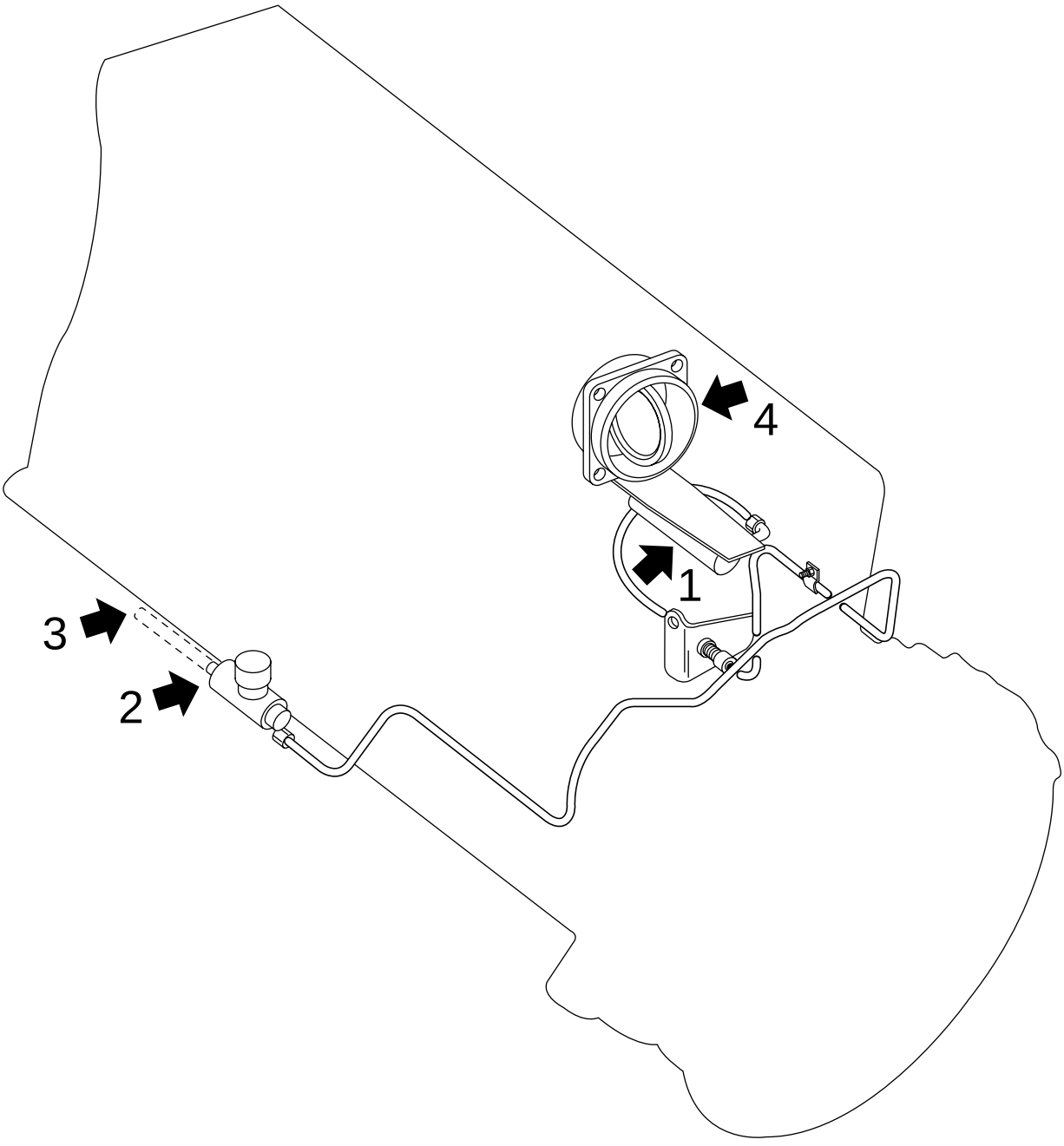
Position A:
DEB switched off

Position B:
DEB switched on
Lubricating-oil pressure between 1.5 and 8 bar

Position C:
DEB switched on
Lubricating-oil pressure ≥ 8 bar



2.6 DESCRIPTION OF EXHAUST BRAKE SYSTEM



1. Engine stop operating cylinder
2. Butterfly valve operating cylinder
3. Engine stop valve
4. Supply pressure
5. Butterfly valve housing

Switching on the exhaust brake
The exhaust brake consists of an engine brake control switch fitted in the cab floor, an engine brake valve (2), an operating cylinder (1) connected to the butterfly valve (4) in the exhaust pipe.
If the engine brake control switch is operated, a signal is passed to the CTE unit. This signal activates the engine brake valve (2), causing compressed air to flow to the operating cylinder (1).
The latter cylinder closes the butterfly valve in the butterfly valve housing. The exhaust pipe is then almost entirely closed off.
Controlled discharge of exhaust gases is still possible through a calibrated hole in the butterfly valve.
The engine now acts as a compressor, creating a braking action.
The higher the engine speed, the greater the braking action of the exhaust brake.

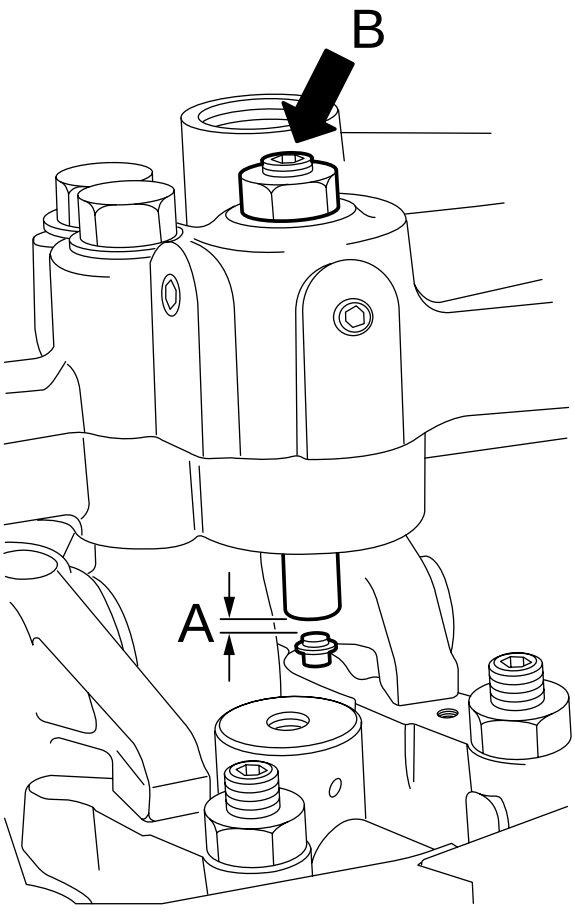
Switching off the exhaust brake
If the engine brake control switch is released, the engine stop valve will bleed the two cylinders. The springs fitted in the cylinders force the pistons back into in their starting position, thus re-opening the butterfly valve and restoring the fuel supply.

3. INSPECTION AND ADJUSTMENT

3.1 INSPECTION AND ADJUSTMENT, DEB PLAY

When the engine is or parts thereof are opened, it is possible for dirt to penetrate which can result in serious damage to the engine. You should therefore clean the engine before opening it.

1. Remove the valve covers.
2. Tighten the DEB fixing bolts to the specified torque, see main group “Technical data”.
3. Use special tool (DAF no. 1310477) to crank the engine in the direction of rotation until cylinder 1 has reached the top dead centre (TDC) and the valves of cylinder 6 rock.
4. Use set screw (B) to set the DEB play (A) of cylinders 1, 3 and 5, see main group “Technical data”.
   Then tighten set screw (B) to the specified tightening torque, see main group “Technical data”.
5. Use special tool (DAF no. 1310477) to crank the engine in the direction of rotation until cylinder 6 has reached the top dead centre (TDC) and the valves of cylinder 1 rock.
6. Use set screw (B) to set the DEB play (A) of cylinders 2, 4 and 6, see main group “Technical data”.
   Then tighten set screw (B) to the specified tightening torque, see main group “Technical data”.
7. Fit the valve covers.



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3.2 FUNCTIONAL CHECK OF DEB

Electrical DEB check

1. Disconnect both DEB connectors at the valve cover.
2. Check the magnetic valve for an open circuit and for the correct resistance value using a multimeter (set to the resistance value position). See main group “Technical data”.
3. Check whether the magnetic valve is short-circuited to the vehicle’s earth.
4. Connect a multimeter (set to the volt measuring position) to the connector of the engine wiring harness.
5. Start the engine and, using the throttle, increase the engine speed to approx. 1500 rpm.
6. Activate the engine brake by means of the engine brake control switch on the cab floor. The multimeter should display a reading. See main group “Technical data”.

   Note:
   As the CTE checks the activation of the engine brake, it will disengage the engine brake below a certain engine speed (see CTE systems manual).

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Mechanical DEB check

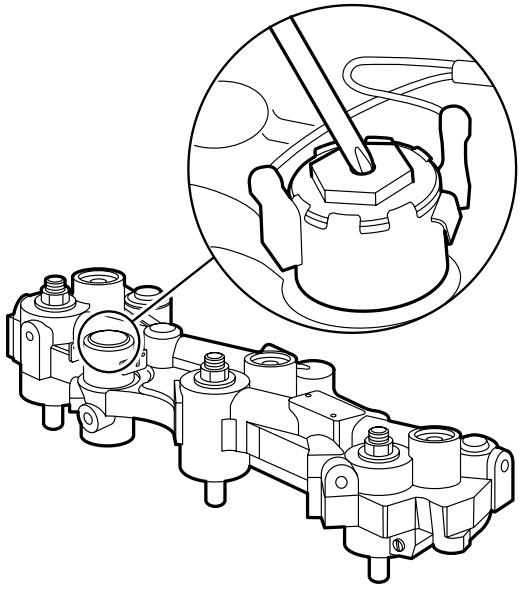
When the engine is run without the valve covers, hot lubricating oil may escape from the engine. Make sure you are adequately protected.

When the engine is or parts thereof are opened, it is possible for dirt to penetrate which can result in serious damage to the engine. You should therefore clean the engine before opening it.

Note:
If the DEB has been removed, you must first switch the DEB on and off several times with the engine running. This is done to bleed the DEB and fill it with lubricating oil.

1. Remove the valve covers.
2. Start the engine, and run it at idling speed.
3. **Note:**
   When the DEB is mechanically activated, the fuel pump is **not** switched into the stop position and continues to inject fuel. Each DEB should therefore be activated for as brief a period of time as possible.

   Use a small screw driver to push the pin in the centre of the magnetic valve downwards. The DEB has now been activated mechanically.
4. Visually check whether the main and operating pistons of the DEB move and/or the exhaust valve is opened.
5. When you switch off the DEB, check whether lubricating oil is discharged from the control valves.
6. Fit the valve covers.



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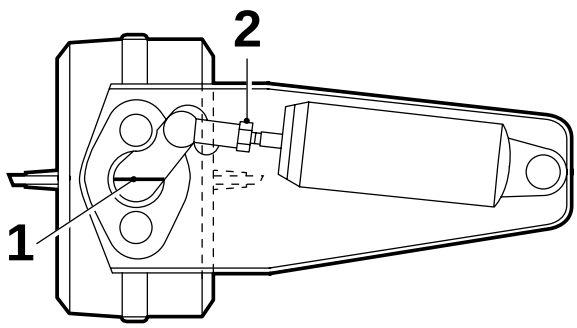
3.3 INSPECTION AND ADJUSTMENT OF EXHAUST BRAKE

Adjusting the exhaust brake

1. Release the ball head of the butterfly valve control lever.
2. Open the butterfly valve fully (engine brake inactive), indicated by the mark (1) on the butterfly valve shaft.
3. Set the length of the piston rod (2) making sure that without air pressure, a pre-stress is present of 1 to 2 mm.
4. Use air pressure to check the exhaust brake for smooth operation.



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4. REMOVAL AND INSTALLATION

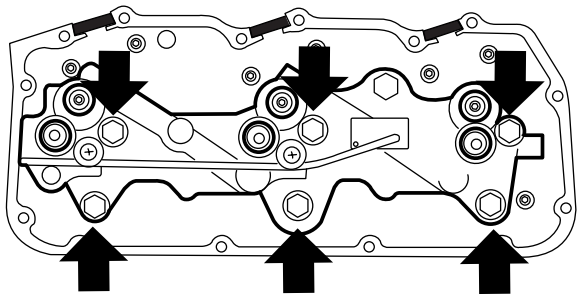
4.1 REMOVAL AND INSTALLATION OF DEB

**Make sure that the spring plate (5) under the main piston (4) is not damaged or deformed.
When the DEB is in operation, this spring plate, if it is damaged or disformed, can break off and result in serious damage to the engine.**

When the engine is or parts thereof are opened, it is possible for dirt to penetrate which can result in serious damage to the engine. You should therefore clean the engine before opening it.

Removing the DEB

1. Remove the valve covers.
2. Disconnect the electrical connections and remove the wiring harness from its housing.
3. Remove the DEB fixing bolts and the entire DEB.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Installing the DEB

1. Tighten the rocker bracket fixing bolts to the specified torque, see main group “Technical data”.
2. **Note:**
   Note that there are two different DEB housings for cylinders 1 to 3, and cylinders 4 to 6, indicated on the DEB housing.

   Place the DEB on the rocker brackets
3. Insert the DEB fixing bolts and tighten them to the specified tightening torque, see main group “Technical data”.
4. Attach the electrical connections.
5. Adjust the valve clearance.
6. Set the DEB clearance, see chapter “Inspection and adjustment”.
7. Fit the valve covers.

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4.2 REMOVAL AND INSTALLATION OF DEB SPRING PLATE

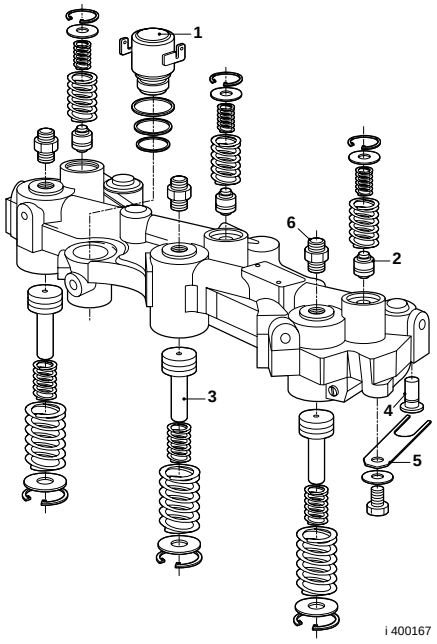
Removing the DEB spring plate

1. Remove the DEB.
2. Remove the spring plate (5) with shim and fixing bolt.

Installing the DEB spring plate

Note:
To prevent the spring plate from being damaged or broken, it should be positioned very carefully.

1. Use the special tool (DAF no. 1329321) to position the spring plate (5) onto the main piston (4).
2. Install the washer with fixing bolt and tighten it to the specified tightening torque, see main group “Technical data”.
3. Install the DEB.



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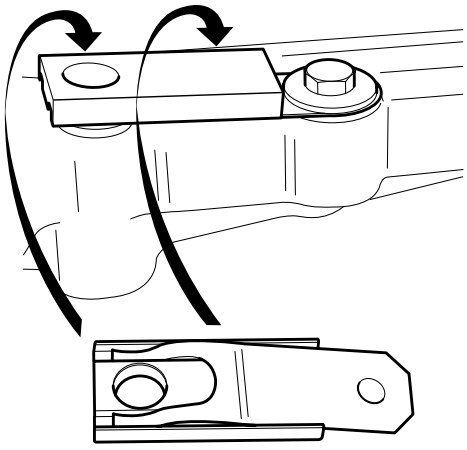
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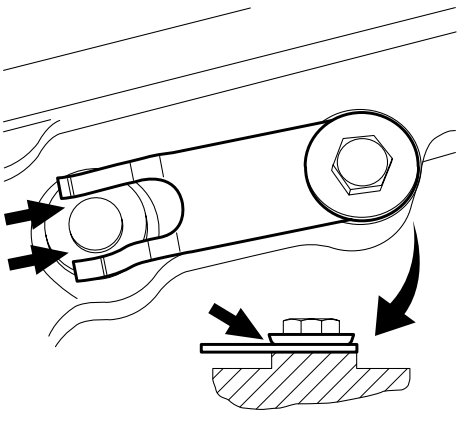
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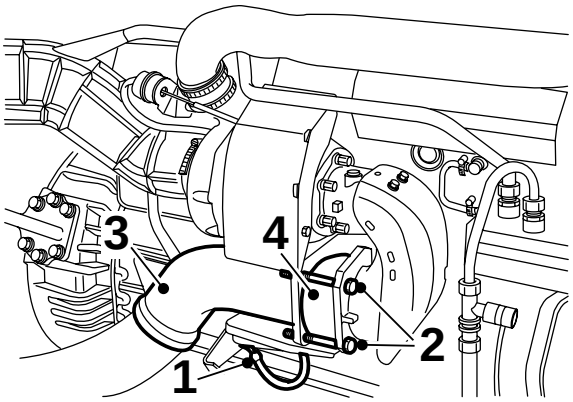
4.3 REMOVAL AND INSTALLATION OF EXHAUST BRAKE



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Removing the exhaust brake

1. Disconnect the air supply connector (1) from the operating cylinder.
2. Remove the attachment (2) holding the butterfly valve housing in the exhaust pipe.
3. Remove the flexible exhaust pipe (3).
4. Remove the entire exhaust brake (4).

Installing the exhaust brake

1. Check the butterfly valve for smooth operation.
2. Check the sealing faces of the butterfly valve housing and the exhaust pipes.
3. Clean the fixing bolts and apply heat-resistant grease to the threads.
4. Install the four fixing bolts and the exhaust brake.
5. Install the flexible exhaust pipe.
6. Tighten the attachment of the butterfly valve housing evenly.
7. Check the setting of the exhaust brake. See “Inspection and adjustment”.

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