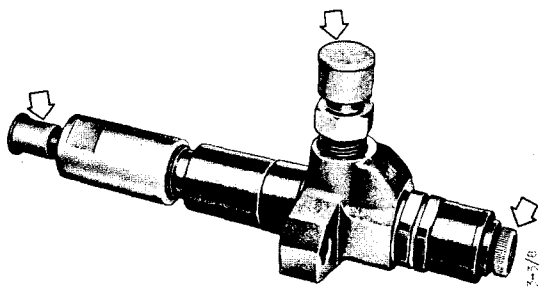
INJECTORS

Removing an Injector

Always put protective caps on injectors and pressure pipes, and in the sleeve in the cylinder head, as soon as an injector is removed from the engine.



Injector with protective caps

If the sealing washers do not come up with the injectors during removal, get them up using the puller.

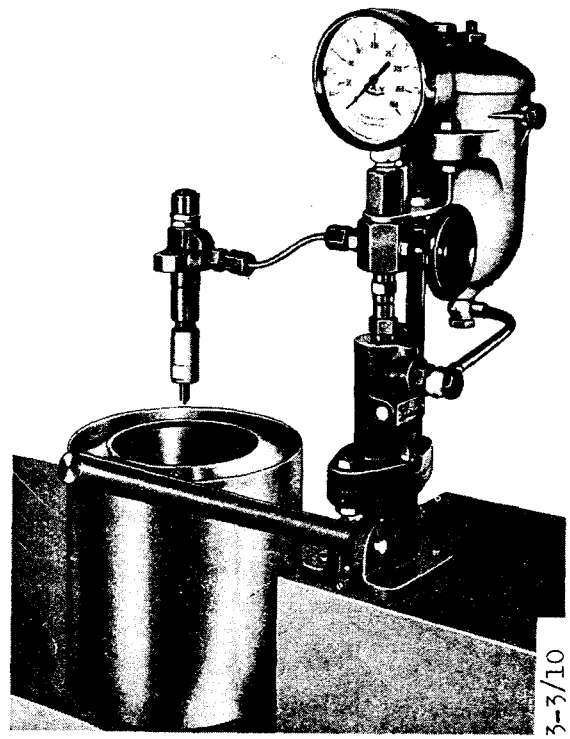
Clean the outside of the injector

Injector Maintenance

In testing injectors, great care must be taken to keep the hands out of the way of the spray, which has great penetrating force and can produce blood poisoning.

CHECKING

Clean the outside of the injector before testing and disassembling it. This is best done with a liquid cleaning agent – gasoline, kerosine or white spirit – and a stiff brush.. Never use a knife or similar implement to remove coke or carbon from the nozzle.



Nozzle-testing outfit

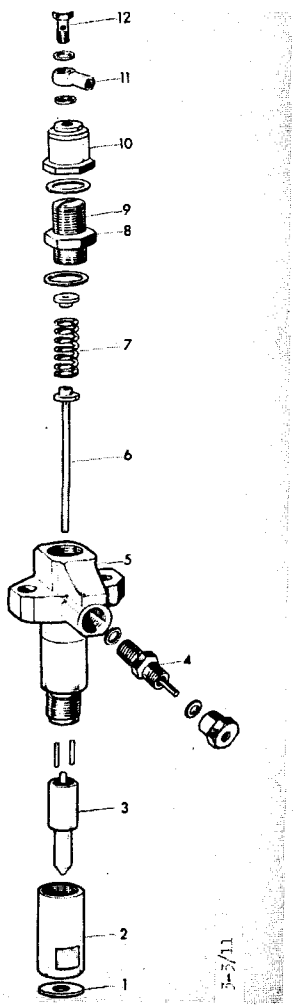
75.15266/3200-10.251

Before dismantling an injector, place it in a nozzle-testing outfit to be checked according to the following points:

1. A check on the opening pressure of the injector.
2. A check on the pressure drop.
3. A check on the sealing of the valve needle against its seat.
4. A check on the spray form.
5. A check to see that the valve needle is working properly.

   For testing instructions, see under the heading "Checking and Setting"

Use a carefully filtered test oil – we suggest Esso Mentor 28 or Shell Fusus Oil – in the testing outfit.

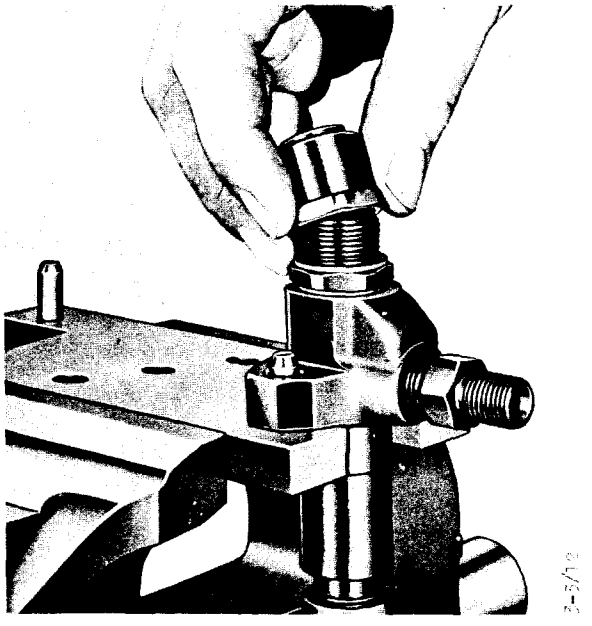


Injector with adjusting screw for opening pressure

1. Washer
2. Nozzle cap nut
3. Nozzle body with valve needle
4. Edge filter
5. Nozzle-holder body
6. Valve spindle
7. Valve spring
8. Locknut
9. Set screw
10. Cap nut
11. Banjo connection for leak-off pipe
12. Hole screw

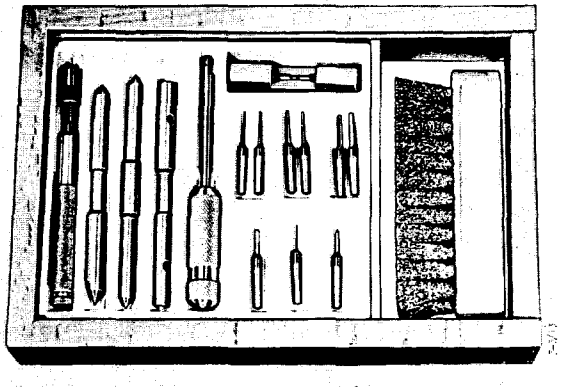
DISMANTLING

If the injector does not function as it should, it must be taken apart and cleaned. Set the injector up in a fixture with the nozzle body downwards. Take off the cap nut, the copper gasket, the locknut, the second copper gasket, the set screw, the valve spring and the valve spindle. Then reverse the injector in the fixture and take out the nozzle cap nut and the nozzle body with the valve needle.



Removing the nozzle cap nut

It is most important to unload the valve spring before undoing the nozzle cap nut. Otherwise damage may be done.

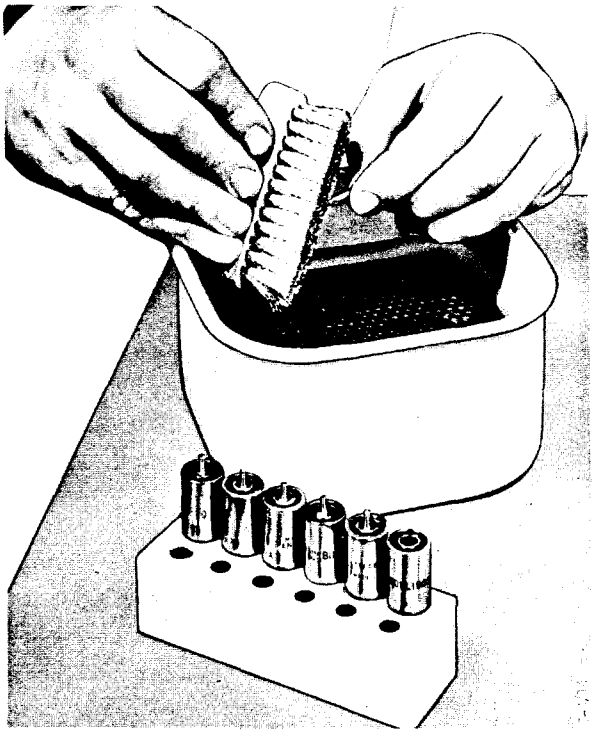


Cleaning tools for injectors (CAV)

CLEANING

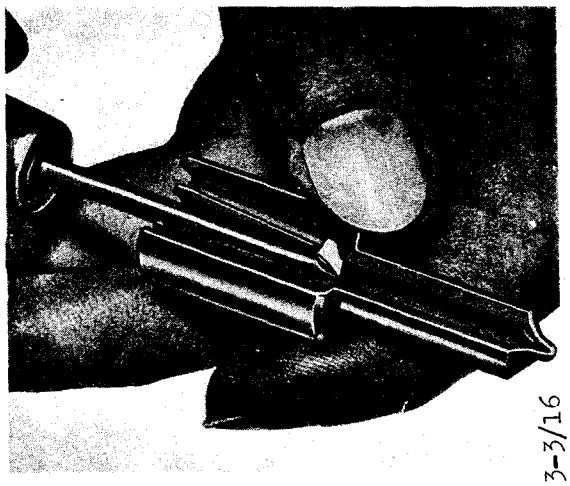
Clean the valve needle with a brush and a liquid cleaning agent. If it is difficult to get the valve needle quite clean, a special resin solvent should be used.

Be careful to see that each valve needle is fitted into the right nozzle body. These items are accurately mated.

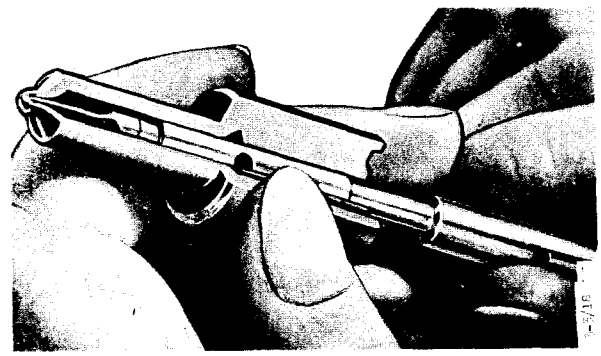


To avoid confusion, the nozzles should be placed in a nozzle rack.

Clean the inside of the nozzle body with brushes and a liquid cleaning agent. Use a resin solvent if required.

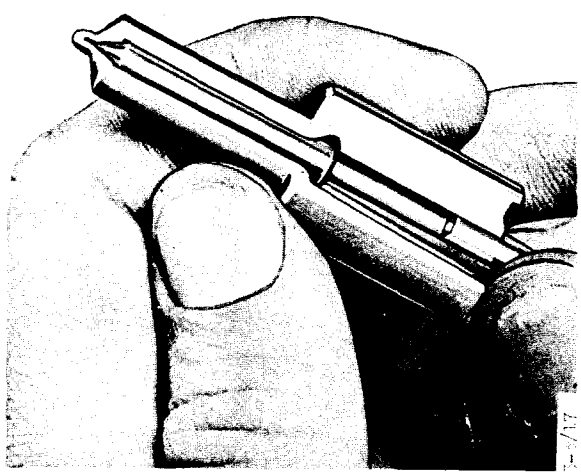


Clean the fuel gallery with a special groove scraper. Rotate the scraper in the gallery and at the same time press hard against the sides of the cavity to scrape off all deposits. When inserting the scraper into the nozzle body be careful not to scratch the locating surfaces.

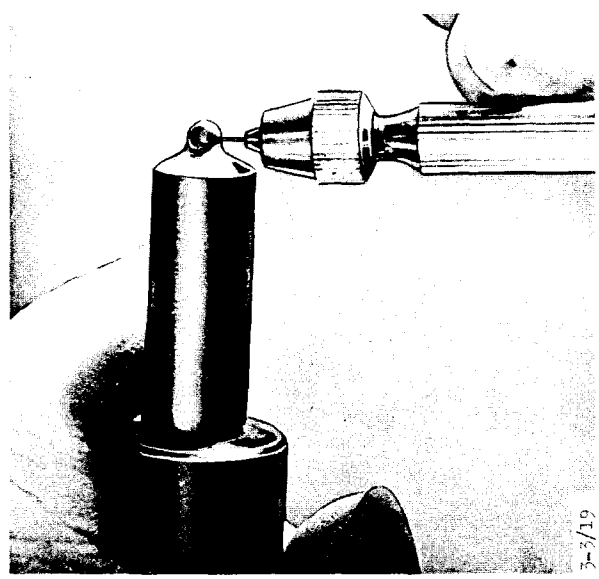


Clean the annular cavity between the seat and needle of the nozzle. Introduce the scraper until it bottoms and then rotate it.

Scrape away any soot in the tip of the nozzle body.

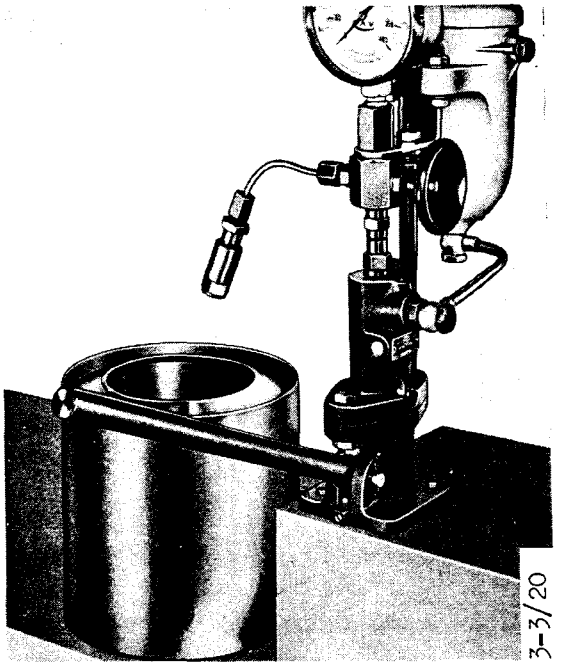


Clean the seat of the needel valve. Use the conical seat scraper, rotating it while pressing it against the seat.

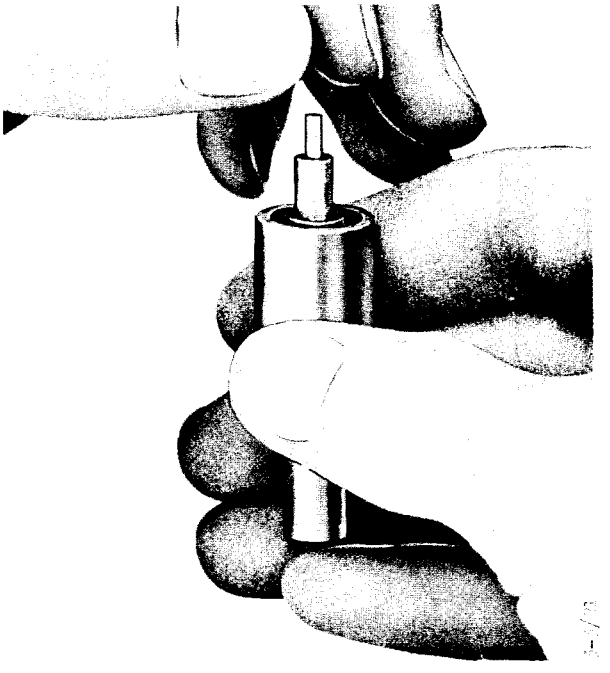


Clean the nozzle holes. Check that there are no burrs on the cleaning wire. Polish it on a honestone. To avoid damage to the nozzle holes during cleaning, the diameter of the cleaning wire should be 0.02–0.03 mm less than the hole diameter.

Then flush the nozzle in white spirit and blow it dry with compressed air.



Flush out the nozzle body. For this purpose there is a special flushing tool which is connected to the nozzle-testing outfit. Fit the nozzle body into the flushing tool and connect the latter to the testing outfit. Disconnect the pressure gauge and pump vigorously.



Test this a number of times and rotate the valve needle each time so that it is brought to a new position. If the needle shows a tendency to stick, dip it again in diesel fuel oil and then rub it in the nozzle body. Then clean the needle and body and blow them dry, dip the needle in diesel fuel oil and test the fit in the same way as before.

Nozzle maintenance over and above that described in the foregoing must not be attempted.

The edge filter in the delivery connection stud of the pressure pipe is cleaned as follows:

Detach the delivery connection stud from the injector. Shut off the pressure gauge of the nozzle-testing outfit. Connect the delivery connection stud to the testing outfit using the flushing tool. Give a few vigorous strokes of the pump lever, which will wash out by the back way any dirt that may be in the edge filter.

N.B. The rod in the filter should never be taken out of the delivery connection stud.

Check the fit of the valve needle in the nozzle body. This check is carried out as follows:

Flush the valve needle and nozzle body thoroughly in kerosine or an equivalent, and blow them dry with compressed air. Then dip the valve needle into well-filtered diesel fuel oil and push it into the guide of the nozzle body. If the clearance in the guide is correct, and if the parts are thoroughly cleaned, the needle should slide easily without the slightest tendency to stick. If the nozzle is held vertically and the needle is lifted up about 10 mm and then released, it should slip down into the body by its own weight.

ASSEMBLY

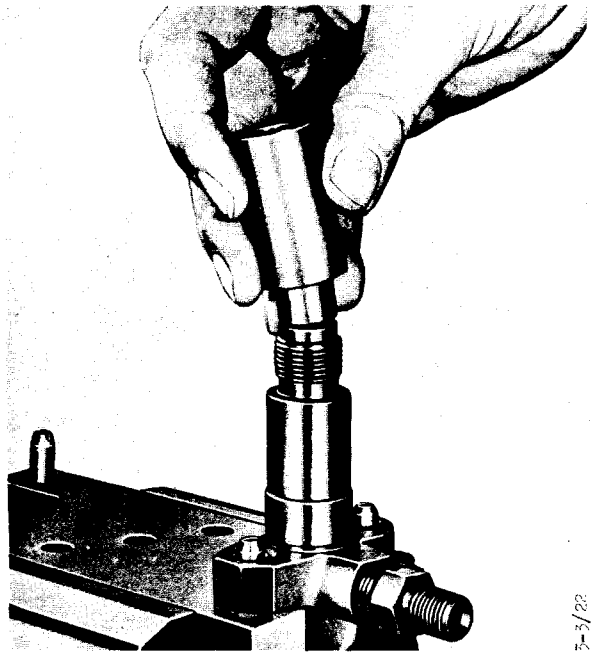
Before the injector is assembled the nozzle body and other components should be thoroughly rinsed in a cleaning liquid and inspected for defects on the pressure faces and threads. Discard defective components.

First place the nozzle-holder body in the fixture and fit the nozzle and the nozzle-cap nut.

Then reverse the nozzle holder in the fixture and fit the valve spindle, valve spring, set screw, gasket and locknut.

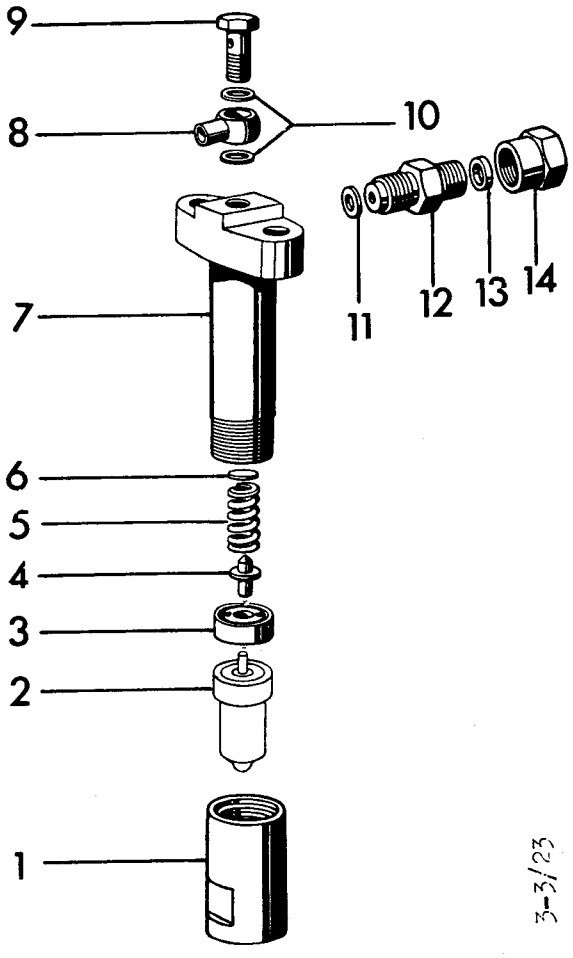
Always use open-ended wrenches.

75.15266/3200-10.251



Always fit the nozzle and nozzle cap first

1. Cap nut
2. Nozzle
3. Spacer washer
4. Pressure bolt with guide sleeve
5. Spring
6. Adjusting washer, is stocked in different sizes from 1.0 to 1.8 mm
7. Holder
8. Connection
9. Hole screw
10. Gasket
11. Gasket
12. Connection with edge filter
13. Washer
14. Cap nut



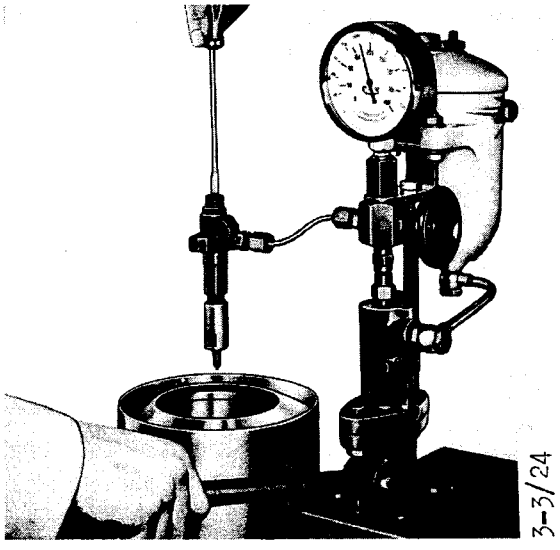
Injector with adjusting washers for opening pressure

Checking and Setting

Connect the injector to the nozzle-testing outfit and go through the following check list. Note the results on a test sheet.

1. SETTING THE OPENING PRESSURE OF THE INJECTOR (INJECTOR WITH ADJUSTING SCREW)

   First open the valve to the pressure gauge and then adjust the spring loading by screwing in the adjusting screw on the injector.



While the set screw is being screwed in, work the hand pump and check the opening pressure. When the injector is correctly adjusted the needle valve should open at the stated pressure. Then lock the set screw with the locknut.

2. CHECKING THE PRESSURE DROP

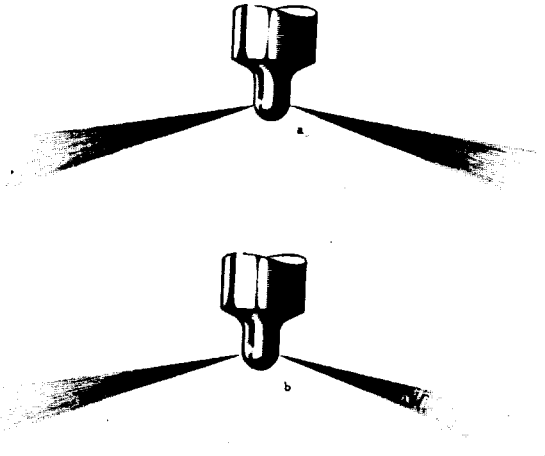
Pump up the pressure in the same way as in checking the opening pressure and then allow the pressure to fall. Read off the time taken for the pressure to drop from 100 to 75 kp/cm^2. The permissible time is 6—25 seconds for the nozzles.

If the time is too short it indicates that the clearance between the valve needle and the nozzle body is too large or that the needle does not seal tightly against the seat, thus allowing too much leak-off oil to pass this way.

N.B.See that the screwed connections are tight and that the valves of the nozzle-testing outfit are in good condition, since the test will otherwise be misleading.

3. CHECKING THE SEALING OF THE VALVE NEEDLE AGAINST THE SEAT

Before this test is performed the nozzle tip should be blown thoroughly dry with compressed air. Then pump the pressure up slowly to about 10 kp/cm^2 below the opening pressure. Keep the pressure close to this value, e.g. by light strokes or by slowly depressing the pump lever of the testing outfit over about ten seconds. During this time, not more than a faint dampness can be allowed to appear round the nozzle holes. If the nozzle does not satisfy this test, the needle can be gently rubbed in against its seat after being dipped in clean diesel fuel oil. Grinding or lapping paste must not be used.



4. CHECKING THE SPRAY FORM

Connect the injector to the nozzle-testing outfit and shut off the pressure gauge. Slacken the set screw on the injector enough to remove the spring thrust against the valve spindle and valve needle. Give a few gentle, long strokes of the pump (with the pump lever going right to the bottom). A nozzle in good condition has a spray form like that shown in Fig. a. There must be no streaks. A faulty spray form is shown in Fig. b.

5. CHECKING THE VALVE NEEDLE FOR CORRECT FUNCTION

When the pump lever of the nozzle-testing outfit is worked slowly the needle will open and shut at a relatively high frequency during the pump strokes, which may produce a "creaking" sound. But it is not necessary for the injector to "creak".

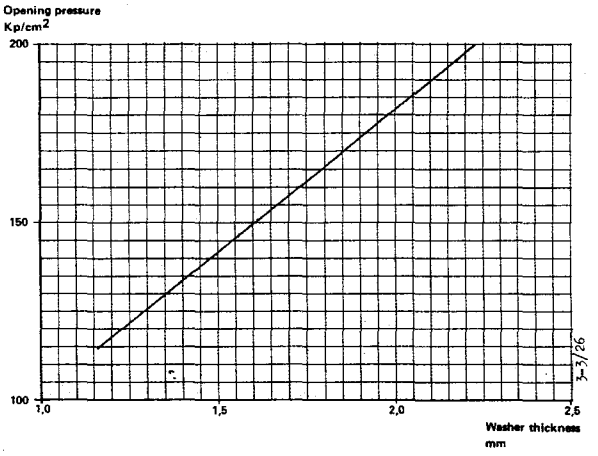
To see whether the valve needle is functioning properly, work the pump slowly and check at the same time that the fuel spray is cut off sharply when the needle closes. See otherwise the instruction issued by the manufacturer.

THE OPENING PRESSURE OF THE INJECTOR (INJECTOR WITH ADJUSTING WASHERS)

The adjustment of the opening pressure is done with aid of spacer washer (6) which is available in varying thicknesses between 1.0 to 1.8 mm.

The choice of a suitable thickness adjusting washer is facilitated with aid of the diagram below, which shows the connection between washer thickness and opening pressure.

75.15266/3200-10.251



The approximate connection between opening pressure and washer thickness

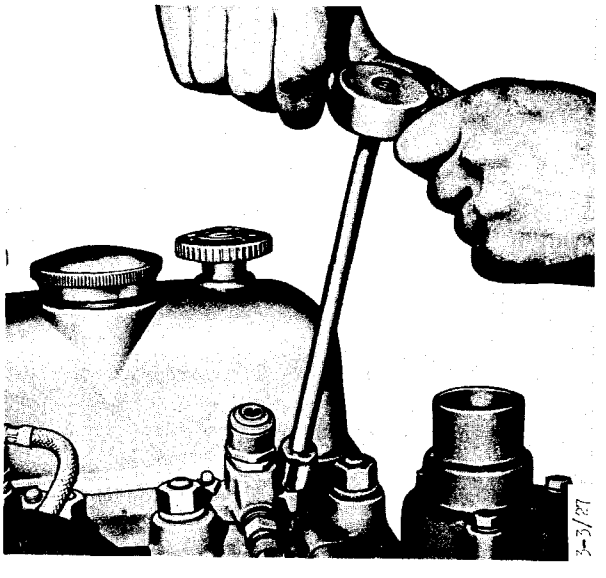
For the remaining service measures to be taken reference is made to the recommendations under point A above to applicable extent and the instruction issued by the manufacturer.

Fitting an Injector into the Cylinder Head

Check that none of the sealing washers has been overlooked down in the injector sleeve. Always fit new washers.

When the injector has been placed in the sleeve the nuts must be tightened to the stated torque. This tightening torque is obtained automatically if the appropriate torque wrench is used.

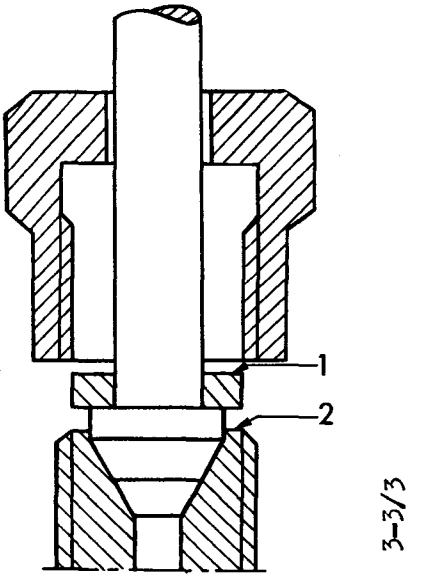
N.B. Overtightened nuts may cause the valve needle to stick in the nozzle body.



Always use a torque wrench in tightening the injectors

Fitting the Pressure Pipe

Be careful to see that the cones of the pressure pipes fit properly into the connection studs. If the pressure pipes are at an angle when the cap nuts are made tight the result will be to deform the cones and leakage will appear.
Tighten the cap nuts to the prescribed torque.



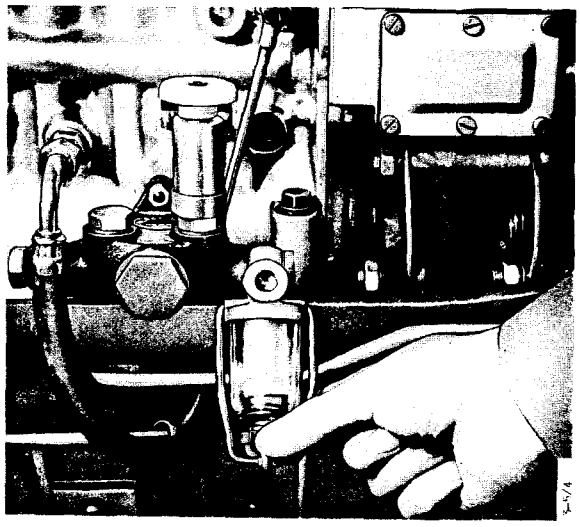
Pressure pipe and cap nut on injection pump or injector. The surfaces 1 and 2 must be parallel

The clamps for the pressure pipes are intended to damp down the vibrations in the pipes, thereby reducing the risk of their cracking. So do not forget to screw these clamps into place. When replacing pressure pipes make quite sure that the pipe for the engine with the correct dimensions is fitted.

FUEL SYSTEM MISC

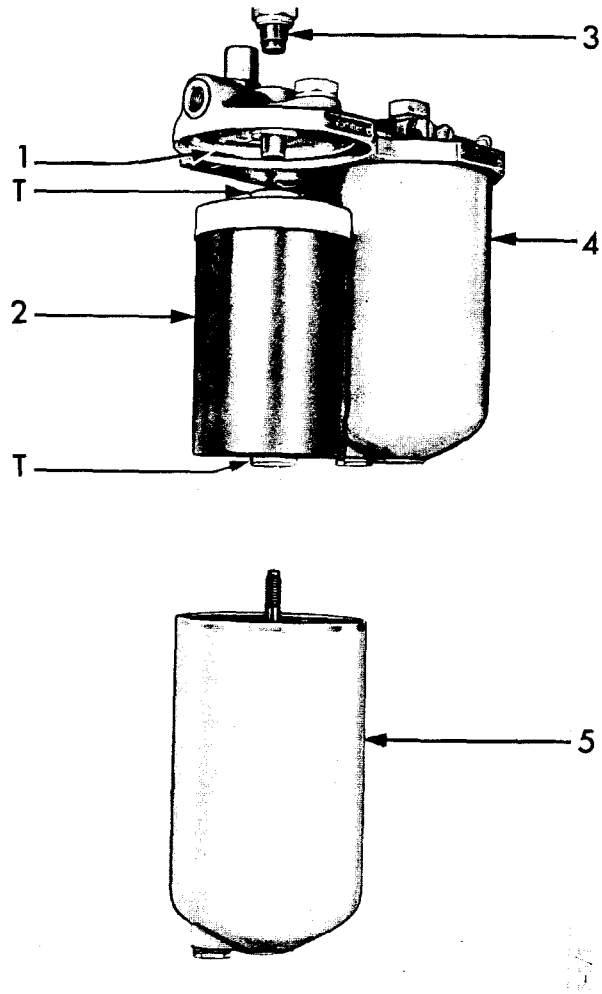
Cleaning the Prefilter on the Feed Pump (Bosch)

Undo the knurled nut, turn the bail out and take out the filter housing. The wire gauze is washed in gasoline or diesel fuel oil. With time the sealing ring becomes so hard that it is of no further use. It must therefore be renewed in good time to prevent air from penetrating into the fuel system.



Detaching the prefilter of the feed pump (Bosch)

1. Clean the outside of the filter housings and the cover.
2. Drain the fuel out of the filter housings by screwing out the drain plugs.
3. Disassemble the prefilter by undoing the screw (4).



Main filter (Bosch)
1. Gasket
T. Felt seals
2. Filter element
3. Screw
4 and 5. Filter housings

Changing Elements in the Main Filter

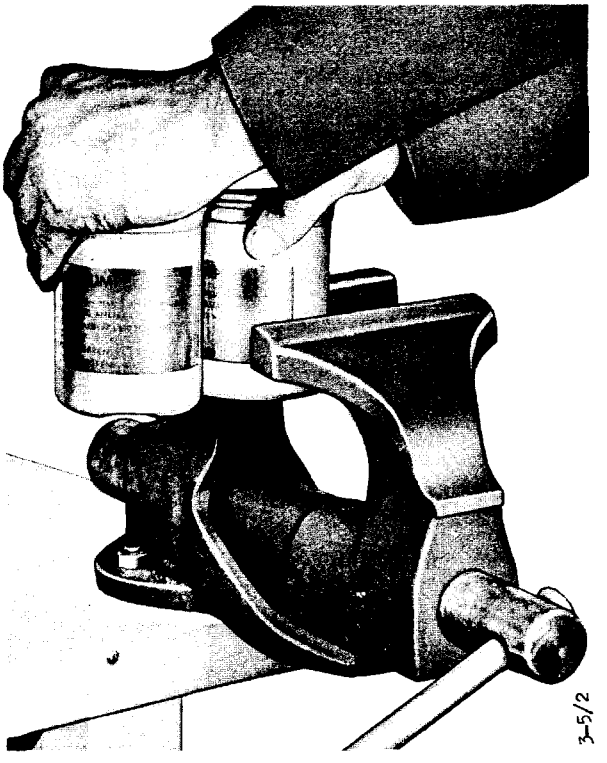
BOSCH MAIN FILTER NO. 0 450 230 005

The two filter housings are connected in series and have the same type of filter element (paper). Impurities in the fuel will therefore for the most part be separated out in the prefilter. In changing its element, proceed as followss:

75.15266/3200.10.251

4. Clean the filter housing in clean fuel oil.
5. Put the new filter element into the filter housing. Examine the felt seals (T), to see that they are effective, since otherwise fuel oil will be able to pass the filter without being cleaned. Check also that the gasket (1) is sound and that there is a copper washer on the screw (3) when it is screwed in.
6. Tighten the drain plugs.
7. Finally, bleed the whole fuel system.

Note. If there is apparent reason for changing the element in the lead-sealed fine filter as well, this job can be done in corresponding fashion. In this case, a fresh lead seal must be put on this filter after the insert has been fitted.



If the filter element is tightly on unscrew it in a vice or with aid of a suitable tool.

MAIN FILTER (BOX FILTER) BOSCH NO. 450 136 002

Replacing Elements

The two filter housings fitted by the side of each other have the same type of filter element and they are connected in parallel.

Both filter and housings comprise one complete unit which is exchangeable. When changing the filter both the filter housings shall be replaced.

Proceed then in the following manner:

1. Clean the filter housing and cover externally.
2. Undo the filter housings. If they are fixed tightly on use a suitable tool in order to detach them or remove the complete filter and unscrew the housings in a vice.

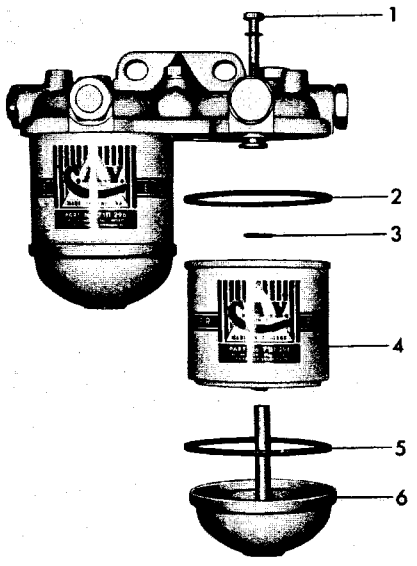
Fit two new filter housings, but check first of all to see that the rubber gasket at the top is faultless. Tighten the filter housings by using both hands.

Bleed the fuel system. While doing so undo the two bleeder screws located at the top on the main filter. Check to be certain that no fuel leakage occurs.

Main Filter CAV Type FS

The filter is available both as single or double design and is then parallel-connected. The element is fitted between the filter cover and the lower part.

1. Shut off the fuel supply (the tank is located higher than the filter).
2. Clean the filter externally, using for instance diesel fuel oil.
3. Loosen the centre bolt on the top of the filter and remove the lower part.
4. While turning the filter element, pull it downwards.
5. Fit new gaskets into the filter cover and the lower part. Replace also the O-ring sealing between the filter element and the filter cover. This O-ring is a sealing between the filtered and contaminated fuel.



Main filter (CAV type FS)

1. Centre bolt
2. Gasket
3. O-ring
4. Filter element
5. Gasket
6. Lower part

6. Fit the new filter element, the lower part and the centre bolt. Tighten it moderately.
7. Open the fuel supply and bleed the system.
8. Check that no leakage occurs.

GENERAL

Specifications

For more detailed information reference is made to Service Instructions for the assemblies.

Injection pump	Governor	Injector Nozzle	Injector Holder
	Engine Type D5		
CAV	CAV	CAV	CAV
NNL4H90/406	GLPE44	BDLL150S6438	BKBL97S5275B
NNL4H90/416	GLWEB23	BDLL150S6438	BKBL97S5275B
NNL4H90/421	GLPE44	BDLL150S6438	BKBL97S5275B
	Engine Type DS5		
CAV	CAV	BOSCH	BOSCH
NNL4H90/401	GLVWEB19	DLLA150S494	KBAL97S19/4
NNL4H90/401	GLVWEB23	DLLA150S494	KBAL97S19/4
	Engine Type D8		
CAV	CAV	CAV	CAV
NNR6H90/407	GLPE43	BDLL150S6438	BKBL97S5275B
NNR6H90/408	GLVWEB22	BDLL150S6438	BKBL97S5275B
NNR6H90/422	GLPE23	BDLL150S6438	BKBL97S5275B
NNR6H90/423	GLVWEB22	BDLL150S6438	BKBL97S5275B
	Engine Type DS8		
CAV	CAV	BOSCH	BOSCH
NNR6H90/399	GLVWEB22	DLLA150S494	KBAL97S19/4
BOSCH	BOSCH		
PE6P100/720RS140	RQV200-1200PA170R	DLLA150S494	KBAL97S19/4
PE6P100A720RS201	RQV200-1200PA170R	DLLA150S494	KBAL97S19/4
	Engine Type D11		
BOSCH	BOSCH	BOSCH	BOSCH
PE6P90/720RS147	EP/MZ80P3R	DLLA150S496	KBL112S28/13
PE6P90/720RS149	EP/MZ80P4R	DLLA150S496	KBL112S28/13
PE6P90/720RS148	RQV250-1100PA47R	DLLA150S496	LBL112S28/13
PE6P90/720RS148	RSV350-1100P1/310R	DLLA150S496	KBL112S28/13
PE6P90A720RS205	EP/MZ80P3R	DLLA150S549	KBL112S28/13
PE6P90A720RS205	EP/MZ80P4R	DLLA150S549	KBL112S28/13
PE6P90A720RS206	RQV250-110PA169R	DLLA150S549	KBL112S28/13
PE6P90A720RS204	RSV350-1100P1/310R	DLLA150S549	KBL112S28/13
PE6P90A720RS206	RQV250-110PA169R	DLLA150S549	KBL112S28/13
PE6P90A720RS204	RSV350-1100P1/310R	DLLA150S549	KBL112S28/13

Engine Type DS11

PE6P100/720RS145	RQV250-1100PA58R	DLLA150S495	KBL112S28/13
PE6P100/720RS146	RSV350-1100P1/310R	DLLA150S495	KBL112S28/13
PE6P100/720RS145z	RQV250-1100PA106R	DLLA150S495	KBL112S28/13
PE6P100/720RS145	RQV250-1100PA153R	DLLA150S495	KBL112S28/13
PE6P100A720RS202	RQV250-1100PA168R	DLLA150S548	KBL112S28/13
PE6P100A720RS203	RSV350-1100P1/310R	DLLA150S548	KBL112S28/13
PE6P100A720RS202z	RQV250-1100PA167R	DLLA150S548	KBL112S28/13
PE6P100A720RS202	RQV250-1100PA167R	DLLA150S548	KBL112S28/13

Engine Type DSI11

PE6P100/720RS146y	RSV350-1100P1/310R	DLLA150S495	KBL112S28/13
PE6P100A720R203y	RSV350-1100P1/310R	DLLA150S548	KBL112S28/13

Injection order 4 cylinder engines 1243
Injection order 6 cylinder engines 153624
Overflow valve CAV7019/239C
Feed pump D5, DS5, D8 CAV DFP3E/64
Feed pump DS8 with CAV pump DFP3E/64
Feed pump DS8 with Bosch pump FP/K22P6
Feed pump D11, DS11, DS111 Bosch FP/K22P6

INJECTION PUMP

Setting Values, Tightening Torques

Engine Type		D5 D8	DS5 DS5	DS8	D11	DS11
Injection pump	Setting on engine Control rod opening max.	1) 2)	1) 2)	1) 2)	1) 2)	1) 2)
Clutch			**CAV**		**Bosch**	
Lock nut for clutch half on driving shaft			20-22 Nm (2,0-2,2 kgm)		62-67 Nm (6,2-6,7 kgm)	
Mounting nut for disc plates			28 Nm (2,8 kgm)		62-67 Nm (6,2-6,7 kgm)	
Mounting nut for clutch half on pump shaft			58 Nm (5,8 kgm)		130-140 Nm (13-14 kgm)	
Setting mark on Bosch clutch		–	–	6 R	6 R	6 R
Feed pressure (measured in injection pump fuel chamber) at max. speed and load		0,6-0,8 bar (0,6-0,8 kg/cm^2) min. 0,3 bar (min. 0,3 kg/cm^2)				
Overflow valve	Opening pressure	approx. 0,5 kg/cm^2		0,5 bar		
Pressure pipe	Inner diameter mm	1,7	1,7	2	1,7	2
Cap nuts	Tightening torque	14,7-19,6 Nm (1,5-2 kgm)				
Engine speed	Low idling rev/min High idling " Max. load "	500-550 2650[3] 2400	500-550 2650 2400	450-500 2650 2400	450-500 2450[3] 2200	450-500 2450 2200

1) See value indicated on engine
2) See value punched on pump and appropriate service information
3) With the damping device out of function

Tools

Description	D5, DS5 D8, DS8 Part No.	D11, DS11 Part No.	Class	See page Work Description	Remarks
Check tool for control rod opening, CAV pump complete	87165	–	1	5	
Spare pointer for 87165, set of two	79003	–	1		
Check tool for control rod opening, Bosch pump of B-design. Bosch part No. EFEP172. Pointer for ditto Bosch Part No. EFEP336/0/3	–	–		5	a)
Check tool for control rod opening. Bosch-pump of P-design with smoke limiter and at the front the cold start button is located (...RS31 and ...RS82) complete. The set consists of tool 87055 (dial indicator holder, screw and magnet) and dial indicator 79004 packed in a plastic case 79001 with element 79002.	–	79005	1	6	
Check tool for control rod opening Bosch-pump of P-design without smoke limiter and with long control rod (...RS31). (Combined with dial indicator holder, screw, magnet and dial indicator from 79005).	–	79000	1	6	
Check tool for control rod opening Bosch-pump of P-design without smoke limiter and with short control rod and rocker-arm controlled cold start (...RS73,...RS74,...RS75,...RS91, ...RS110). The set consists of tool 79097 (hexagon spacer sleeve with mounting bushing, distance pin, clamp with retaining screw for magnet including screw with lock nut for fixing the clamp in the dial indicator) packed in plastic case 79098 with element 98062. (Combined with dial indicator holder, screw magnet and dial indicator from 79005.)	–	79099	1	7	
Distance pin (spare part for 79099).	–	98087	1	7	
Check tool for control rod opening, Bosch-pump of P-design with smoke limiter and side located cold-start button (...RS95). The tool consists of magnet holder and retaining plate for dial indicator holder (combined with dial indicator-holder, screw, magnet and dial indicator 79005).	–	98068	1		
Drive roller for tachometer (centrifugal Governors)	–	87241	1		

a) The tool is delivered by Bosch.

INJECTION PUMP

CAUTION

This section is applicable to only Waukesha models F674D, DS, and DSI, which are designated by Scania as D, DS, and DSI11A04, A05, A06, and A07. Engine serial numbers for these models are from 888806 (Sweden) and 156300 (Netherland).

Specifications

Injection sequence	1-5-3-6-2-4
Pump setting, injection commences	See sign plate on valve casing
Stting mark (Bosch)	6R
Feed pressure:	
Measured in injection pump fuel chamber	0.6–0.8 bar (kp/cm^2)
At. max. speed and load	0.3 bar (kp/cm^2)
Engine speed	
Low idling	450–500 r.p.m.
High idling	2 450 r.p.m.
Max. full-load speed	2 200 r.p.m.

Tightening torques

Screws: injection pump - pump shelf	39 Nm (3.9 kpm)
Screws for discs	65 Nm (6.5 kpm)
Screw (clamped joint) in front coupling half	65 Nm (6.5 kpm)
Nut for coupling half on camshaft	100–110 Nm (10–11 kpm)
Nuts for pressure pipe	15–20 Nm (1.5–2.0 kpm)

Tool

	Art. No.	Class
Key for coupling half	98435	3

SP

77.21159/3200-1081

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
DS11R01A, DS11R02A, DS11R06, DS11R07, DS11C01, DS11C02	1-5-3-6-2-4

Pump/Pumpe	Centrifugal Governor/~~Pneumatic Governor~~ Fliehkraftregler/Unterdruckregler
Bosch PE6P100/720RS145	RQV250-110PA58R

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
Bosch DLLA150S495 (five holes)	200 kp/cm² (196 bar)	~ 0.80 kp/cm² (~0.78 bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch pintle type nozzles DN12SD12EFEP182	175 kp/cm² (172 bar)	600·6·3 mm

A Pump Element Setting Pumpenelementeinstellung

Stroke Position No. 1 mm Vorhub Nr. 1 mm	~~Top Position No. 1 mm~~ Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	5	3	6	2	4		Tolerance Toleranz
2.60+ 0.10		Position Lage	0°	60°	120°	180°	240°	300°		±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

Test Teilprüfung No. Nr.	Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max Q_{max}- Q_{min}	Notes Anmerkung
1	Full load speed, max. torque	600	Full speed stop	13.5	156-160	6.0	Q_2-Q_1 = 3±1.5
2	Max. full load speed	1100	Full speed stop	13.5	159-163	6.0	
3	Low idling	225	Low speed stop	~6.0	11-13	1.5	CRO_4 = CRO_3
4	High idling	1200	Full speed stop	~6.0	40-45	4.0	
5							
6							

C Governor Setting Reglereinstellung

Test Teilprüfung No. Nr.	Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel β°	CRO mm RW mm			Notes Anmerkung
1	Preparations						Set graduated disc. on zero
2		1100		14.0-16.0			
3	Full speed test	1200	66 ± 1	3.6-9.6			
4		1310		0			
5		200		6.0-8.0			
6		300		3.1-5.2			
7	Low speed test	400	10 ± 1	1.8-3.6			
8		600		0-1.0			
9		650		0			
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

Test Teilprüfung No. Nr.	Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Overpressure Überdruck mm Hg	Notes Anmerkung
1	Setting of smoke limiter	1100	Full speed stop	13.5	160-162	500	Tolerance CRO ± 0.5
2	Cut-off curve begins	1120	Full speed stop	13.3		500	CRO begins to decrease
3	Smoke limiter test	500	Full speed stop	12.3	130-134	0	CRO_1-CRO_3 = 1.2
4	Smoke limiter test	500	Full speed stop	13.4		189-205	Pressure reduction from 500
5	Smoke limiter test	500	Full speed stop	12.5		103-129	
6	Cold start test	0	~40	~20			Press in the cold start control
7	Cold start test	0	From min. to max.	12.3			Move the speed lever
8	Cold start test	60		~20	200-250	0	
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
D11R01, D11R02, D11R06, D11R21	1-5-3-6-2-4

Pump/Pumpe	~~Centrifugal Governor~~/Pneumatic Governor Fliehkraftregler/Unterdruckregler
Bosch PE6P90/720RS147	EP/MZ80P3R

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
Bosch DLLA150S496 (five holes)	200 kp/cm² (196 bar)	~ 0.80 kp/cm² (~0.78bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch DN12SD12EFEP182	175 kp/cm2 (172 bar)	600·6·3 mm

A Pump Element Setting Pumpenelementeinstellung

Stroke Position No. 1 mm Vorhub Nr. 1 mm	~~Top Position No. 1 mm~~ Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	5	3	6	2	4		Tolerance Toleranz
2.60+ 0.10		Position Lage	0°	60°	120°	190°	240°	300°		±0,5° (not No. 1 nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max Q_{max} - Q_{min}	Notes Anmerkung
1	Full load speed, max. torque	600		14.5	137-141	5.0	Q_2-Q_1 = 5± 1.5
2	Max. full load speed	1100		14.5	142-146	5.0	
3	Low idling	225		~ 6.0	16-18	1.5	CRO_4 = CRO_3
4	High idling	1200		~ 6.0	1)	4.0	1) Q_4 = Q_3+ max. 20
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Vacuum U mm water col.		Notes Anmerkung
1	Preparations	0					Idling damper spring out of function
2	Increasing vacuum	1100		13.0	340-360		
3	Ditto	1100		7.0	375-395		U_3-U_2 min. 35
4	Decreasing vacuum	1100		13.0	U_4		U_2-U_4 max. 15
5							
6							
7							
8							
9							
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Cold start test	0		3)			Move the lever to one sid
2	Cold start test with stop arm			14.5			3) Cold start position
3							
4							
5							
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions

F Miscellaneous Sonstiges

75.15266/3200-10.251
10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
D11R01, D11R06, D11R07	1-5-3-6-2-4

Pump/Pumpe	Centrifugal Governor/~~Pneumatic Governor~~ Fliehkraftregler/Unterdruckregler
Bosch PE6P90/720RS148	RQV250-1100PA47R

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
Bosch DLLA150S496 (five holes)	200 kp/cm² (196 bar)	~0.80 kp/cm² (~0.78bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch pintle type nozzles DN12SD12EFEP182	175 kp/cm² (172 bar)	600·6·3 mm

A Pump Element Setting Pumpenelementeinstellung

Stroke Position No. 1 mm / Vorhub Nr. 1 mm	~~Top Position No. 1 mm~~ Spitzenlage Nr. 1 mm	Element No. / Element Nr.	1	5	3	6	2	4		Tolerance / Toleranz
2.60+0.10		Position / Lage	0°	60°	120°	180°	240°	300°		±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max $Q_{max}-Q_{min}$	Notes Anmerkung
1	Full load speed max. torque	600	Full speed stop	14.5	137-141	5.0	$Q_2-Q_1 = 5 \pm 1.5$
2	Max. fuel load speed	1100	Full speed stop	14.5	142-146	5.0	
3	Low idling	225	Idling stop	~6.0	16-18	1.5	CRO_4-CRO_3
4	High idling	1200	Full speed stop	~6.0	1)	4.0	1) $Q_4 = Q_3 + max.\ 20$
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel $\beta°$	CRO mm RW mm			Notes Anmerkung
1	Preparations						Set graduated disc. on zero
2		1100		15.0-17.8			
3	Full speed test	1200	62 ± 1	5.0-10.0			
4		1280		0-0			
5		200		5.8-8.0			
6		300		3.1-4.4			
7	Low speed test	400	10 ± 1	2.6-3.6			
8		600		0.8-2.0			
9		780		0-0			
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting max. fuel delivery	1100	Suitable position	14.5	143-145		Tolerance CRO ± 0.5
2	Cut-off curve begins	1120	Full speed stop	14.3			CRO begins to decrease
3	Cold start test	0	Medium position	3)			3) Cold start position
4	Cold start test	0	Idling stop				
5	Cold start test	0	Full speed stop	14.5			
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

75.15266/3200-10.251
10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
DS8R01, DS8LB01, DS8C01	1-5-3-6-2-4

Pump/Pumpe	Centrifugal Governor ~~Pneumatic Governor~~ Fliehkraftregler/Unterdruckregler
Bosch PE6P100/720RS140	RQV200-1200PA101R

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
Bosch DLLA150S494 (five holes)	200 kp/cm² (196 bar)	~ 0.80 kp/cm² (~0.78bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch pintle type nozzles DN12SD12EFEP182	200 kp/cm² (172 bar)	600·6·3 mm

A Pump Element Setting Pumpenelementeinstellung

Stroke Position No. 1 mm Vorhub Nr. 1 mm	~~Top Position No. 1 mm~~ Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	5	3	6	2	4		Tolerance Toleranz
2.50+ 0.10		Position Lage	0°	60°	120°	180°	240°	300°		±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max Q_{max}- Q_{min}	Notes Anmerkung
1	Full load speed max. torque	600	Medium position	14.0	115-119	5.0	Q_2-Q_1 = 8 ± 1.5
2	Max. full load speed	1200	Full speed stop	14.0	123-127	5.0	
3	Low idling	225	Idling stop	~ 6.0	12-14	1.5	CRO_4 = CRO_3
4	High idling	1300	Full speed stop	~ 6.0	30-35	4.0	
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel β°	CRO mm RW mm			Notes Anmerkung
1	Preparations	0	0	0-0			Set graduated disc. on zero
2	Full speed test	1200	66 ± 1	15.0-17.6			
3	Full speed test	1300	ditto	8.7-13.2			
4	Full speed test	1400	ditto	1.4-8.1			
5	Full speed test	1550	ditto	0-0			
6	Low speed test	200	10 ± 1	6.2-8.0			
7	Low speed test	300	ditto	3.7-5.9			
8	Low speed test	400	ditto	2.1-3.6			
9	Low speed test	550	ditto	0-0			
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Overpressure Überdruck mm Hg	Notes Anmerkung
1	Setting the max. fuel delivery	1200	Suitable position	14.0	124-126		Tolerance CRO ± 0.5
2	Cut-off curve begins	1220	Full speed stop	13.8			CRO begins to decrease
3	Cold start test	0	Medium position	3)			3) Cold start position
4	Cold start test	0	Idling stop				
5	Cold start test	0	Full speed stop	14.0			
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

75.15266/3200-10.251
10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
DS8R01, DS8LB01, DS8C01	1-5-3-6-2-4

Pump/Pumpe	Centrifugal Governor/~~Pneumatic Governor~~ Fliehkraftregler/Unterdruckregler
CAV NNR6H90/399	GLVWEB22 (225-1200)

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
Bosch DLLA150S494 (five holes)	200 kp/cm² (196 bar)	~0.80 kp/cm² (~0.78bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch pintle type nozzles DN12SD12EFEP182	175 kp/cm² (172 bar)	600·6·3 mm

A Pump Element Setting Pumpenelementeinstellung

~~Stroke Position No. 1 mm~~ Vorhub Nr. 1 mm	Top Position No. 1 mm Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	5	3	6	2	4		Tolerance Toleranz
	0.50 ± 0.05	Position Lage	0°	60°	120°	180°	240°	300°		±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max Q_{max} - Q_{min}	Notes Anmerkung
	Full load speed max. torque	600	Medium position	14.5	106-110	5.0	Q_2-Q_1 = 9 ± 1.5
2	Max full load speed	1200	Full speed position	14.5	115-119	5.0	
3	Low idling	225	Idling position	~ 6.0	11-13	1.5	CRO_4 = CRO_3
4	High idling	1300	Full speed position	~ 6.0	30-35	4.0	
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm			Notes Anmerkung
1							Spring tension one turn
2							down
3							
4							
5							
6							
7							
8							
9							
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting the max.fuel delivery	1200	Suitable position	14.5	116-118		Tolerance CRO ± 0.5
2	Cut-off curve begins	1220	Full speed stop	14.3			CRO begins to decrease
3	Cold start test	60	Medium position	~ 20	150-190		Stop arm extended
4	Cold start test	0	Ditto	0			With tooth segment
5	Cold start test	0	Full speed stop	14.5			Full speed setting
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

SE, SF, SG

75.15266/3200-10.251 10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ: **D8R01, D8R02, D8R20, D8LB01, D8LB02**

Firing Order/Zündfolge: **1-5-3-6-2-4**

Pump/Pumpe: **CAV NNR6H80/338**

~~Centrifugal Governor~~/Pneumatic Governor
Fliehkraftregler/Unterdruckregler: **GLPE34**

Nozzles/Einspritzdüsen: **CAV BDLL150S6403 (four holes)**

Opening Pressure/Öffnungsdruck: **135** kp/cm² (**132** bar)

Test Bench Feed Pressure
Prüfbank Förderdruck: **~0.80** kp/cm² (**~0.78** bar)

Test Bench Equipment/Prüfbank: **Bosch pintle type nozzles DN12SD12EFEP182**

Opening Pressure/Öffnungsdruck: **175** kp/cm² (**172** bar)

Delivery Pipes/Druckrohre: **600·6·2 mm**

A Pump Element Setting Pumpenelementeinstellung

~~Stroke Position No. 1 mm~~ Vorhub Nr. 1 mm	Top Position No. 1 mm Spitzenlage Nr. 1 mm	Element No. / Element Nr.	1	5	3	6	2	4			Tolerance Toleranz
	0.50 ± 0.05	Position Lage	0°	60°	120°	180°	240°	300°			±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max $Q_{max} - Q_{min}$	Notes Anmerkung
1	Full load speed, max. torque	600		13.0	83-87	4.0	$Q_2-Q_1 = 7 \pm 1.5$
2	Max. full load speed	1200		13.0	90-94	4.0	
3	Low idling	225		~6.0	10-12	2.0	
4	High idling	1300		~6.0	11-13	3.0	$CRO_4 = CRO_3$
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Vacuum U mm water col.		Notes Anmerkung
1	Preparations	0					Idling damper spring out of function
2	Increasing vacuum	1200		11	380-400		
3	Ditto	1200		7	400-420		
4	Decreasing vacuum	1200		11	U_2-max.15		
5							
6							
7							
8							
9							
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting max. fuel delivery	1200		13.0	91-93		Tolerance CRO ± 0.5
2							
3	Cold start test						
4							
5							
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

SE, SF, SG

75.15266/3200-10.251
10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ: **D8R01, D8R02, D8R20, D8LB01, D8LB02**

Firing Order/Zündfolge: **1-5-3-6-2-4**

Pump/Pumpe: **CAV NNR6H80/360**

Centrifugal Governor/~~Pneumatic Governor~~
Fliehkraftregler/Unterdruckregler: **GLVWB15 etc. GLVWEB 16 etc.**

Nozzles/Einspritzdüsen: **CAV BDLL150S6403 (four holes)**

Opening Pressure/Öffnungsdruck: **135** kp/cm² (**132** bar)

Test Bench Feed Pressure
Prüfbank Förderdruck: **~ 0.80** p/cm² (~**0.78** bar)

Test Bench Equipment/Prüfbank: **Bosch pintle type nozzles DN12SD12EFEP182**

Opening Pressure/Öffnungsdruck: **175** kp/cm² (**172** bar)

Delivery Pipes/Druckrohre: **600·6·2 mm**

A Pump Element Setting Pumpenelementeinstellung

~~Stroke Position No. 1 mm~~ Vorhub Nr. 1 mm	Top Position No. 1 mm Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	5	3	6	2	4	Tolerance Toleranz
	0.50 ± 0.05	Position Lage	0°	60°	120°	180°	240°	300°	±0,5° (not No. 1. / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max $Q_{max} - Q_{min}$	Notes Anmerkung
1	Full load speed, max. torque	600	Full speed stop	13.0	83-87	4.0	$Q_2 - Q_1 = 7 \pm 1.5$
2	Max. Full load speed	1200	Full speed stop	13.0	90-94	4.0	
3	Low idling	225	Idling stop	~ 6.0	10-12	2.0	
4	High idling	1300	Full speed stop	~ 6.0	11-13	3.0	$CRO_4 = CRO_3$
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm			Notes Anmerkung
1	Preparations						
2							
3							
4							
5							
6							
7							
8							
9							
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting max. fuel delivery	1200	Suitable position	13.0	91-93		Tolerance CRO ± 0.5
2	Cut-off curve begins	1220	Full speed stop	12.8			
3	Cold start test						
4							
5							
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

SE, SF, SG

75.15266/3200-10.251
10x50 12 70 117313
SV 299 a

Test Schedule
Injection Pump for **TruckEngines**
Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ: **DS5R01**

Firing Order/Zündfolge: **1-2-4-3**

Pump/Pumpe: **CAV NNL4H90/401**

Centrifugal Governor/~~Pneumatic Governor~~ Fliehkraftregler/Unterdruckregler: **GLVWEB19 (226-1200)**

Nozzles/Einspritzdüsen: **Bosch DLLA150S494 (five holes)**

Opening Pressure/Öffnungsdruck: **200** kp/cm² (**196** bar)

Test Bench Feed Pressure Prüfbank Förderdruck: **~0.80** kp/cm² (**~0.78** bar)

Test Bench Equipment/Prüfbank: **Bosch pintle type nozzles DN12SD12EFEP182**

Opening Pressure/Öffnungsdruck: **175** kp/cm² (**172** bar)

Delivery Pipes/Druckrohre: **600·6·2 mm**

A Pump Element Setting Pumpenelementeinstellung

~~Stroke Position No. 1 mm~~ Vorhub Nr. 1 mm	Top Position No. 1 mm Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	2	4	3				Tolerance Toleranz
	0.50 ± 0.05	Position Lage	0°	90°	180°	270°				±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max $Q_{max}-Q_{min}$	Notes Anmerkung
1	Full load speed max. torque	600	Full speed stop	14.5	112-116	5.0	$Q_2-Q_1 = 23 \pm 1.5$
2	Max.full load speed	1200	Full speed stop	14.5	135-139	5.0	
3	Low idling	225	Idling stop	~6.0	12-14	1.5	
4	High idling	1300	Full speed stop	~6.0	30-35	4.0	$CRO_4 = CRO_3$
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm			Notes Anmerkung
1	Preparations						
2							
3							
4							
5							
6							
7							
8							
9							
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting the max. fuel delivery	1200	Suitable position	14.5	136-138		Tolerance CRO ±0.5
2	Cut-off curve begins	1220	Full speed stop	14.3			CRO begins to decrease
3	Cold start test	0	Medium position	3)			3) Cold start postion
4	Cold start test	0	Idling stop				
5	Cold start test	0	Full speed stop	14.5			
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

SE, SF, SG

75.15266/3200 10.251
10x50 12 70
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**
Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
D5R01	1-2-4-3

Pump/Pumpe	~~Centrifugal Governor~~/Pneumatic Governor Fliehkraftregler/Unterdruckregler
CAV NNL4H80/339	GLPE38

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
CAV BDLL150S6403(four holes)	135 kp/cm² (132 bar)	~ 0.80 kp/cm² (~0.78 bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch pintle type nozzles DN12SD12EFEP182	175 kp/cm² (172 bar)	600·6·2 mm

A Pump Element Setting Pumpenelementeinstellung

~~Stroke Position No. 1 mm~~ Vorhub Nr. 1 mm	Top Position No. 1 mm Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	2	4	3				Tolerance Toleranz
	0.50 ± 0.05	Position Lage	0°	90°	180°	270°				±0,5° (not No. 1 nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max Q_{max} - Q_{min}	Notes Anmerkung
1	Full load speed max. torque	600		13.5	84-88	4.0	Q_2-Q_1 min. 4
2	Max. full load speed	1200		13.5	91-95	4.0	
3	Low idling	250		~ 5.0	10-12	2.0	
4	High idling	1300		~ 5.0	11-13	3.0	$CRO_4 = CRO_3$
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Vacuum U mm water col.		Notes Anmerkung
1	Preparations	0					Idling damper spring out
2	Increasing vacuum	1200		12	355-375		of function
3	Ditto	1200		7	400-420		U_3-U_2 min. 45
4	Decreasing vacuum	1200		12	U_2-max.15		Start at CRO zero
5							
6							
7							
8							
9							
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	~~Speed Lever~~ Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting max. fuel delivery	1200		13.5	92-94		Tolerance CRO ± 0.5
2	Cold start test	60		~ 20	160-180		
3	Cold start test	0		0			Segments operated
4	Cold start test	0		13.5			Segments released
5							
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

SE, SF, SG

75.15266/3200·10.251
10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
D5R01	1-2-4-3

Pump/Pumpe	Centrifugal Governor/~~Pneumatic Governor~~ Fliehkraftregler/Unterdruckregler
CAV NNL4H80/339	GLVWEB11, GLVWEB17

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
CAV BDLL150S6403(four holes)	135 kp/cm² (132 bar)	~ 0.80 kp/cm² (~0,78 bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch pintle type nozzles DN12SD12EFEP182	175 kp/cm² (172 bar)	600·6·2 mm

A Pump Element Setting Pumpenelementeinstellung

~~Stroke Position No. 1 mm~~ Vorhub Nr. 1 mm	Top Position No. 1 mm Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	2	4	3				Tolerance Toleranz
	0,50± 0,05	Position Lage	0°	90°	180°	270°				±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max Q_{max} - Q_{min}	Notes Anmerkung
1	Full load speed max. torque	600	Full speed stop	13.5	84-88	4.0	Q_2-Q_1 min. 4
2	Max. full load speed	1200	Full speed stop	13.5	91-95	4.0	
3	Low idling	250	Idling stop	~5.0	10-12	2.0	
4	High idling	1300	Full speed stop	~5.0	11-13	3.0	$CRO_4 = CRO_3$
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm			Notes Anmerkung
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting max. fuel delivery	1200	Suitable position	13.5	92-95		Tolerance CRO ±0.5
2	Cut-off curve begins	1220	Full speed stop	13.3			CRO begins to decrease
3	Cold start test	60	Medium position	~20	160-180		
4	Cold start test	0	Ditto	0			Stop arm operated
5	Cold start test	0	Full speed stop	13.5			Full speed setting made
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions.

F Miscellaneous Sonstiges

SE, SF, SG

75.15266/3200-10.251
10x50 12 70 117312
SV 299 a

Test Schedule
Injection Pump for **Truck Engines**

Prüftabelle
Einspritzpumpe für

Date/Datum	Edition/Ausgabe	Setting No./Einstellnr
72-02-01	1	

Engine Type/Motor typ	Firing Order/Zündfolge
DS8R01, DS8B01, DS8C01	1-5-3-6-2-4

Pump/Pumpe	Centrifugal Governor/~~Pneumatic Governor~~ Fliehkraftregler/Unterdruckregler
Bosch PE6P100/720RS140 with overflow valve	RQV200—1200PA101R

Nozzles/Einspritzdüsen	Opening Pressure/Öffnungsdruck	Test Bench Feed Pressure Prüfbank Förderdruck
Bosch DLLA150S494 (five holes)	200 kp/cm² (196 bar)	~ 0.80 kp/cm² (~0.78 bar)

Test Bench Equipment/Prüfbank	Opening Pressure/Öffnungsdruck	Delivery Pipes/Druckrohre
Bosch pintle type nozzles DN12SD12EFEP182	175 kp/cm² (172 bar)	600·6·3 mm

A Pump Element Setting Pumpenelementeinstellung

Stroke Position No. 1 mm Vorhub Nr. 1 mm	~~Top Position No. 1 mm~~ Spitzenlage Nr. 1 mm	Element No. Element Nr.	1	5	3	6	2	4			Tolerance Toleranz
2.50 ± 0.10		Position Lage	0°	60°	120°	180°	240°	300°			±0,5° (not No. 1 / nicht Nr. 1)

B Pump Setting Fördermengeneinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	Max $Q_{max}-Q_{min}$	Notes Anmerkung
1	Full load speed max.torque	600	Medium position	13.5	115-119	5.0	$Q_2-Q_1 = 8 \pm 1.5$
2	Max. full load speed	1200	Full speed stop	13.5	123-127	5.0	
3	Low idling	225	Idling stop	~6.0	12-14	1.5	
4	High idling	1300	Full speed stop	~6.0	30-35	4.0	$CRO_4 = CRO_3$
5							
6							

C Governor Setting Reglereinstellung

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel β°	CRO mm RW mm			Notes Anmerkung
1	Preparations	0	0	0-0			Set graduated disc. on zero
2	Full speed test	1200	66 ± 1	15.0-17.6			
3	Full speed test	1300		8.7-13.2			
4	Full speed test	1400		1.4-8.1			
5	Full speed test	1550		0-0			
6	Low speed test	200	10 ± 1	6.2-8.0			
7	Low speed test	300		3.7-5.9			
8	Low speed test	400		2.1-3.6			
9	Low speed test	550		0-0			
10							

D Final Test of Pump with Governor Endprüfung Pumpe mit Regler

No. Nr.	Test Teilprüfung Name Benennung	Speed Drehzahl n r/min	Speed Lever Reglerhebel	CRO mm RW mm	Q mean mm³/stroke Q Mittel mm³/Hub	~~Overpressure~~ Überdruck mm Hg	Notes Anmerkung
1	Setting the max.fuel delivery	1200	Suitable position	13.5	124-126		Tolerance CRO ± 0.5
2	Cut-off curve begins	1220	Full speed stop	13.3			CRO begins to decrease
3	Cold start test	0	Medium position	3)			3) Cold start position
4	Cold start test	0	Idling stop				
5	Cold start test	0	Full speed stop	13.5			
6							
7							
8							
9							
10							

E Completion Ergänzung

Complete test sheet and seal according to special instructions

F Miscellaneous Sonstiges

SE, SF, SG

75.15266/3200-10.251
10x50 12 70 11312
SV 299 a

INJECTORS

			D5 D8	DS5	DS8	D11	DS11
Injectors	Opening pressure on inspection	kp/cm²	135–145	200–210	200–210	135–145	200–210
	when setting	kp/cm²	140–145	205–210	205–210	140–145	205–210
Nozzle	Hole diameter	mm	0,29–0,31	0,29–0,30	1)		
	Needle lift	mm	0,25–0,30	0,25–0,30	1)		
	Solex B	mm w.g.	210–240	200–230	1)		
Retaining nuts	Tightening torque	kpm	1,0	1,0	1,0	1,0	1,0

1) See appropriate Service Instruction for injection equipment

3. FUEL- AND EXHAUST SYSTEM

a. D5, DS5, D8, DS8. D11, DS11

List of Contents

	Number
General	0
Injection Pump	1
Speed Regulators	2
Injectors	3
Fuel System, misc.	5
Exhaust System	6

START AV MOTOR VID KYLA.

Gäller motorer med köldstart enligt fig. Gäller ej generator-aggregat.

1 Koppla om möjligt ur aggregat som drivs av motorn (t.ex. hydraulpumpar) för att motorn ska gå så lätt som möjligt.

2 Skjut in stoppreglaget.
eller
Återställ elstoppet till driftläge.

3 Dra köldstartarmen åt sidan enligt pilen i fig. Släpp sedan armen!

4 Ge fullgas och håll kvar detta läge.

5 Tryck in startknappen och håll den intryckt tills motorn orkar gå av egen kraft.

Startmotorn får användas upp till 3 minuter i sträck men:

Motorn måste ***börja*** tända inom 1 minut

Batterierna måste vara laddade så att inte varvtalet minskar kraftigt

6 När motorn nått 1000 r/min ändra till lämplig tomgång.

STARTING ENGINE IN COLD WEATHER

Applies to engines with cold start according to figure. Does not apply to generator.

1 Try to disconnect the generator, which is operated by the engine (e.g. hydraulic pumps) in order that the engine will run as smoothly as possible.

2 Push in the stop control
or
Restore the stop magnet to operating position.

3 Pull the cold starter lever to one side as the arrow shows in figure. Then release the lever.

4 Open up the throttle to max. and keep it in this position.

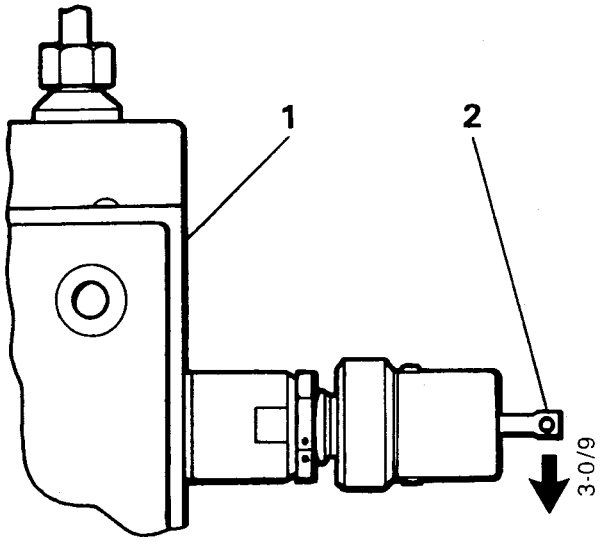
5 Press in the starter button and keep it pressed in until the engine has the power to function on own accord.

The starter motor may be used up to 3 minutes at a time, but

The engine must ***begin*** to fire within 1 minute.

The batteries must be charged so that the engine speed does not drop too quickly.

6 When the engine has reached 1000 r/min change over to an appropriate idling speed.



Köldstart
1 Insprutningspump
2 Köldstartarm

Cold start
1 Injection pump
2 Cold starter lever

3200-1019

SI

SA,SB,SC,SD/SE,SF,SG,SH
SJ,SK,SL,SM

MOTORSTART BEI KÄLTE

Gilt für Motoren mit Kaltstartvorrichtung laut Fig. Gilt nicht für Generatoraggregate.

1 Möglichst vom Motor getriebene Aggregate auskuppeln (z.B. Hydraulikpumpen), damit der Motor so leich wie möglich läuft.

2 Abstellzugschalter einschieben oder Abstellmagnet auf Betriebslage stellen.

3 Kaltstarthebel laut Pfeil in der Figur zur Seite ziehen. Hebel danach loslassen.

4 Vollgas geben und beibehalten.

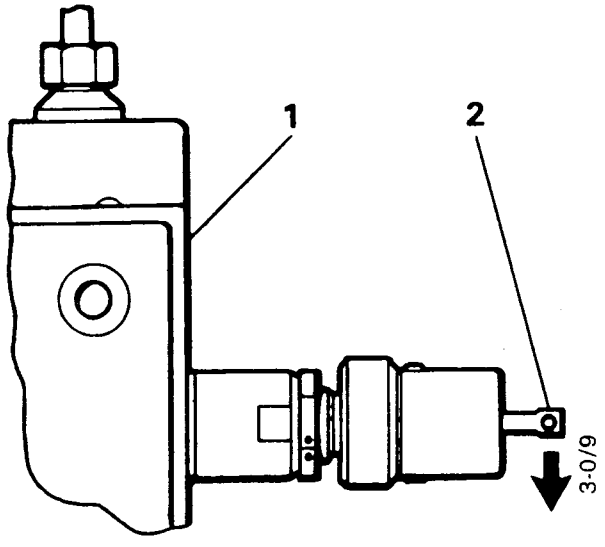
5 Startknopf eindrücken und so lassen, bis der Motor aus eigener Kraft läuft.

Anlasser darf bis zu 3 Minuten ohne Unterbrechung laufen, aber

der Motor muß innerhalb 1 Minute zu zünden ***beginnen***

die Batterien müssen so geladen sein, daß die Drehzahl nicht kräftigt sinkt.

7 Wenn der Motor 1000r/min erreicht hat, auf passenden Leerlauf ändern.



Kaltstart
1 Einspritzpumpe
2 Kaltstarthebel

(Note - Pages 293 thru 296 have been obsoleted)

KÖLDSTARTSVÅRIGHETER D8, DS8 D11, D14 MED BOSCH INSPRUTNINGSPUMP OCH RQV REGULATOR

Bakgrund

Under senaste vinterperioden har i vissa fall köldstartproblem förekommit speciellt med D8 och DS8 motorer.

Aktuell information

Förekommande köldstartproblem kan eventuellt ha förorsakats av att insprutningspumpens reglerstång inte gått fram till fullt köldstartläge trots att köldstartanordningen använts. Detta har i så fall orsakats av att fjäderkraften på reglerstången inte varit tillräckligt stor för att övervinna friktionsmotståndet, orsakat av bl a den kalla oljan i pumpen.

Två ändringar i insprutningspumpens regulator har införts.

- Fr o m ungefär februari 1975 har en något styvare ställbultfjäder införts.
- Under perioden oktober 1974 - februari 1975 monterade Bosch en spelutjämningsfjäder som var något kraftigare (motverkar reglerstångsrörelsen i riktning köldstartläge). Fr o m ungefär februari 1975 har den vekare spelutjämningsfjädern återinförts.

Att iakttaga

Vid fall av klagomål på köldstartproblem bör som första åtgärd fastställas huruvida reglerstången vid kall pump verkligen går fram till fullt köldstartläge vid manövrering av köldstartreglaget. Om så ej är fallet bör kontakt tas med närmaste Bosch auktoriserade serviceverkstad för fastställande av vilken fjäderutrustning som är monterad i aktuell pump.

I de fall köldstartproblem förorsakats av olämplig fjäderkombination kommer Bosch att genom sin organisation accpetera utbyte av fjädrar som normal garantireparation. Detta åtagande kommer att utsträckas över vintersäsongen 1975-76.

COLD STARTING DIFFICULTIES ON D8, DS8, D11, D14 WITH BOSCH INJECTION PUMP AND RQV GOVERNOR

Background

During the last Winter coldstarting difficulties were experienced in some cases, primarily with the D8 and DS8 engines.

Current Information

Such cold starting difficulties may possibly have been caused by the fact that the injection pumps control rod has not moved forward to max. cold starting position despite useage of the cold starting device, In such a case the spring force on the control rod, has not been sufficient to overcome the frictional resistance, caused, among other things, by the cold oil in the pump.

Two modifications have been made to the governor of the injection pump.

- As from approx. February 1975 a slightly more rigid type stud spring has been introduced.
- During the period October 1974 to February 1975, Bosch fitted a clearance equalizing spring which was slightly more robust (counteracts the movement of the control rod in direction cold starting position). As from approx. February 1975 the more pliable clearance equalizing spring was re-introduced.

Attention

In cases of complaint about cold starting problems, the first measure to be taken should be to determine if the control rod, on cold pump, really moves forward to max. cold starting position when operating the cold starting device. If this is not the case then get into touch with the nearest Bosch authorized service workshop for determining which spring equipment is fitted in the pump concerned.

In the event of cold starting difficulties caused by an unsuitable spring combination, Bosch will, via their organization, accept a replacement of springs as normal warranty repair, This commitment will be extended to cover the Winter Season 1975-76.

SI

KALTSTARTSCHWIERIGKEITEN BEI D8, DS8, D11, D14 MIT BOSCH EINSPRITZPUMPE UND RQV-REGLER

Anlaß

Während der letzten Winterperiode sind in gewissen Fällen Kaltstartprobleme besonders bei D8- und DS8-Motoren vorgekommen.

Aktuelle Information

Vorkommende Kaltstartprobleme können eventuell dadurch verursacht worden sein, daß die Regelstange der Einspritzpumpe nicht auf volle Kaltstartlage gegangen ist, obwohl die Kaltstartvorrichtung benutzt wurde. Dies wurde solchenfalls dadurch verursacht, daß die Federkraft der Regelstange nicht groß genug gewesen ist, um den Reibungswiderstand, u.a. durch das kalte Öl in der Pumpe verursacht, zu überwinden.

Zwei Änderungen am Regler der Einsprizpumpe sind eingeführt:

- Ungefähr ab Februar 1975 ist eine etwas steifere Lagerbolzenfeder eingeführt.
- Während der Periode Oktober 1974-Februar 1975 montierte Bosch eine Spielausgleichfeder, die etwas stärker war (Gegewirkung bei der Regelstangenbewegung in Richtung Kaltstartlage). Ungefähr ab Februar 1975 wurde die weichere Spielausgleichfeder wieder eingeführt.

Zu beachten

Bei Klagen über Kaltstartprobleme soll als erste Maßnahme festgestellt werden, inwieweit die Reglerstange bei kalter Pumpe bei Betätigung des Kaltstarts wirklich bis zur vollen Kaltstartlage geht. Wenn dies nicht der Fall ist, sollte man sich mit der nächsten autorisierten Bosch-Service-werkstatt in Verbindung setzen, damit festgestellt wird, welche Federausrüstung in der aktuellen Pumpe montiert ist.

Falls das Kaltstartproblem durch unzweckmäßige Federkombination verursacht ist, wird die Firma Bosch über ihre Organisation das Auswechseln der Federn als normale Garantiereparatur akzeptieren. Diese Vereinbarung erstreckt sich über die Wintersaison 1975-1976.

DIFI CULTADES DE ARRANQUE EN FRIO D8, DS8, D11, D14 CON BOMBA DE INYECCION BOSCH Y REGULADOR RQV

Antecedentes

Durante el último periodo de invierno, han surgido ciertos casos de problemas de arranque en frïo, especialmente con los motores D8 y DS8.

Información actual

Los problemas de arranque en frïo que han surgido, pueden haber estado causados posiblemente por que el vástago de regulación de la bomba de inyección no haya llegado hasta la posición completa de arranque en frïo, a pesar de emplearse el dispositivo de arranque en frïo. Esto ha sido causado por el hechod de que la fuerza del muelle del vástago de reglaje no ha sido lo suficientamente grande para la resistencia de friccioón, causada, entre otras cosas, por el aceite frïo de la bomba.

Se han introducido dos modificaciones en el regulador de la bomba de inyección.

- A partir de, aproximadamente, febrero de 1975, se ha introducido un muelle de perno de ajuste, más rïgido.
- Durante el perïodo octubre de 1974-febrero de 1975, Bosch montó un muelle de igualación de juego que era algo más potente (contrarresta el movimiento del vástago de regulación en el sentido de la posición de arranque en frïo). A partir de aproximadamente febrero de 1975, se ha vuelto a introducir un muelle de igualación de juego, más débil.

Deberá obeservarse

En caso de que surjan quejas en los problemas de arranque en frïo, como primera medida deberá determinarse si el vástago de regulación, con la bomba frïa, verdaderamente llega a plena posición de arranque en frïo, al maniobrar el dispositivo de arranque en frïo. Si no fuera asï, deberán ponerse en contacto con el taller de servicio autorizado de Bosch más cercano, para determinar cuál es el equipo de muelle que está montado en la bomba en cuestión.

En caso de que el problema de arranque en frïo haya sido causado por una combinación de muelle inadecuada, Bosch a través de sum organización aceptará el cambio de muelles como una reparación normal de garantïa. Este ofrecimiento se prolongará durante la temporada de invierno 1975-1976.

GRP	NO	Page Number FU	AR	SP	Applies to: Separate Engines	SI
3c	1	–	–	0	**Injection pump**	
		–	–	0	Injection Equipment for SCANIA Separate Engines	
					Test Schedules	
	2	–	–	1	D5	
	3	–	–	1	DS5	
	4	–	–	1	D8	
	5	–	–	1	DS8	
	6	–	–	1	D11	
	7	–	–	1	DS11	
	8	–	–	1	D14	
	9	–	–	1	DS14	
	10	–	–	–		

Concerning the contents reference is made to section "SPECIAL INFORMATION"

FU AR SP S

3200-962

INJECTION EQUIPMENT FOR SCANIA SEPARATE ENGINES

The table below shows the injection equipment of all the current production separate engines, which are manufactured in Sweden. In column 7 the make of the injector is indicated as well as its 3-figure identification number. In column 13 the nominal opening pressure of the injector is indicated and expressed in bar.

In order to avoid faulty deliveries it is essential that the part numbers in the columns 4,8,10 and 12 are quoted on all orders.

The type designation of the injection pump according to column 3 ends very often without a code letter being affix affixed, thus indicating that the specified output deviates from the basic setting for vehicle operation. An exception is the code y for DSI11R82A, which in addition indicates altered stroke position. Therefore, in the test chart for each injection pump, always indicate the complete type designation.

SEPARATE ENGINES

	MOTOR	INJECTION PUMP					INJECTOR							Press-ure
	Type	Make	Type	Part No.	Gover-nor	α^{o}	Make	Part No.	Holder Type	Part No.	Injector Type	Part No.	Open Press. Bar	Pipe Ø mm
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
A	D5A01	CAV	NNL4H90/421	223901	vakuum vacio	25	CAV	208526	BKBL97S5275B	208550	BDLL150S6438 1)	192247	200	1,7
	»		NNL4H90/425	223909	centr.		200							
	D5M01		»	»	»									
B	DS5R40	CAV	NNL4H90/402	220524	centr.	24	Bosch	211590	KBAL97S19/4	211941	DLLA150S494 2)	211591	200	1,7
	DS5R42						866							
	DS5R80													
C	D8A01	CAV	NNR6H90/422	223963	vakuum vacio	25	CAV	208526	BKBL97S5275B	208550	BDLL150S6438 1)	192247	200	1,7
	»		NNR6H90/423	223964	centr.		200							
	D8M01		»	»	»									
D	DS8R40	CAV	NNR6H90/399	208691	centr.	24	Bosch	211590	KBAL97S19/4	211941	DLLA150S494 2)	211591	200	1,7
	»	Bosch	PE6P100A720RS201	232092	RSV		866							
	»	»	»	223633	RQV									
	DS8R80	CAV	NNR6H90/399	208691	centr.									
	»	Bosch	PE6P100A720RS201	232092	RSV									
E	D11R41	Bosch	PE6P90A720RS204	221658	RQV	27	Bosch	221664	KBL112S28/13	211977	DLLA150S549 2)	221665	200	1,7
	»			222733	RSV		773							
	D11R81			»	»									
F	DS11R40A	Bosch	PE6P100A720RS202	221659	RQV	25	Bosch	221666	KBL112S28/13	211977	DLLA150S548 2)	221667	200	2,0
	»		PE6P100A720RS203	222734	RSV		772							
	DS11R82A		»	»	»									
G	DSI11R82A	Bosch	PE6P100A720RS203 3)	222734	RSV	25	Bosch	221666	KBL112S28/13	211977	DLLA150S548 2)	221667	200	2,0
			PE6P100A720RS203y 4)	222735	»		772							
H	D14A01	Bosch	PE8P110A920/4LS251	232747	RSV	22	Bosch	170991	KBL91S146/4	170994	DLLA150S547 1)	170992	175	2,0
	»		PE8P110A920/4LS208	170990	RQV		775							
	D14M01		PE8P110A920/4LS251	232747	RSV									
I	DS14A01	Bosch	PE8P110A920/4LS207	170996	RQV	25	Bosch	170997	KBL91S146/4	170994	DLLA150S548 2)	221667	200	2,0
			PE8P110A920/4LS209	222984	RSV		774							
K	DSI14M01	Bosch	PE8P110A920/4LS209	222984	RSV	25	Bosch	170997	KBL91S146/4	170994	DLLA150S548 2)	221667	200	2,0
							774							

Remarks:
1) Four holes
2) Five holes
3) Normal output
4) Increased output

SP

3200-478

SE, SH

TEST TABLES FOR SEPARATE ENGINES

List of contents

Instructions covering test tables for separate engines 3c SP 1 p. 3 – 5

Engine Type	INJECTION PUMP		REGISTERING				Δn %	Remarks
	Make	Type	Group	Sec.	No.	Page		
D8	Bosch	PE6P110A720RS261	3c	SP	4	1	6–12	
						2	4	
						3	10	
DS8	Bosch	PE6P110A720RS3013	3c	SP	5	1	4	
						2	10	
D11	Bosch	PE6P110A720RS3005	3c	SP	6	1	6–12	
						2	4	Industrial or generating set engine
						3	4	Marine or generating set engine
						4	10	
	CAV	P5338				5	6–12	
DS11	Bosch	PE6P110A720RS3006	3c	SP	7	1	6–12	
		PE6P110A720RS3014				2	4	
						3	10	
DSI11		PE6P100A720RS203				4	4	
						5	10	
		PE6P110A720RS3016,3014				6	4	
D14	Bosch	PE8P110A920/4LS208	3c	SP	8	1	6–12	
		PE8P110A920/4LS251				2	4	
DS14	Bosch	PE8P110A920/4LS207	3c	SP	9	1	6–12	
		PE8P110A920/4LS209				2	4	
DSI14						3	4	
						4	10	

SP

3200-1084

INSTRUCTIONS FOR TEST SCHEDULES FOR SETTING OF INJECTION PUMPS ON SEPARATE ENGINES

General information about engine output

Our engines are delivered in different designs for varying fields of application. Thus, the output and speed setting varies for these different fields of application, too.

For each engine series D8, DS8, D11, DS11, D14 and DS14 there is a **basic output.** By that we mean the output for which the engine is set, in our trucks, at time of delivery.

This output is obtained when adjusting the injection pump according to the test schedules for the engines in truck designs, which are indicated under Group 3a in the Service Handbook Products.

When corresponding engines are sold as separate engines this basic output is termed **intermittent output** or **110 % output.** This implies that the engine may only be operated at max. output for a limited period.

If an engine is to be operated at a continuous output of max. set output, the engine must be set for max. 100 % output or as it is also called **continuous output.** Consequently, with this output setting, the engine must be operated at max. output for an "unlimited" period.

Two outputs curves are usually shown in the engine diagrams for separate engines. The **top** output curve shows the **intermittent** output of the engine, i.e. **110 %** output. The **bottom** output curve shows the **continuous** output of the engine, i.e. 100 % output according to above.

The type designation of the injection pump is to indicate which output the engine is set to. This type designation ends with a **small code letter** in those cases where the engine is set for an output other than the basic output, ex. Bosch PE6P110A720RS3016 z.

Thus, in order to adjust the injection pump on separate engines, the above-mentioned test schedules under Group 3a shall be used for basic setting of the pump. By doing so the basic output of the engine will be obtained. Any setting of deviations from this output in accordance with the code marking of the pump takes place according to the test schedules under Group 3c by altering the control rod opening to the value indicated. Two of these test schedule setting values are framed. The top value is the **intermittent** output of the engine (110 %) or the basic output of the engine. The bottom value is the **continuous** output of the engine (100 %).

How are the test schedules used?

The **top output level** framed is equivalent to the **intermittent output** mentioned above (110 %). That is the basic output of the engine, which conforms to the basic setting of corresponding truck engine; the type designation of the pump will in such case lack code letter.

The way to use the test schedule is shown below by 3cSP7 page 2 for engine type DS11 as an example. The injection pump of make Bosch is of type PE6P110A720RS3014. In this design, i.e. without code letter, the pump is, according to column 1 and 2 under heading "Basic Values", set at CRO 13.0 with tolerance ±0.5 mm (another tolerance applies in special cases during multiple operation, i.e. multi-engine operation of several engines or units).

In the schedule heading, the equivalent basic setting of the truck engine is indicated according to test schedule 3a SP16 page 9, where the pump, however, has another type designation, PE6P110A720RS3006, because it has another type of centrifugal governor.

In the schedule for the truck engine it is possible to find out which nozzles the engine is equipped with and their opening pressure, and, furthermore, which test bench nozzles are to be used and their opening pressure and the size of the test bench delivery pipes. The different sections are applied according to below.

A. Pump element setting applies without change.

B. Pump setting applies without change.

Test no. B2, B3 and B4 only applies to calibration of the separate pump elements. The final speed setting for the separate engine can deviate. The max. full load speed n_a for the separate engine is shown in the respective table heading.

SP

3200-1084

Low idling n_c for the separate engine is standardized to 700 r/min, which is equal to the figure 350, i.e. corresponding pump speed, in the governor type designation in schedule heading. Deviation **can** occur, e.g. during dumper operation, where a final setting is made in the vehicle.

C. Governor setting only applies in those cases, where the separate engine has the same governor as the truck engine, e.g. Bosch RQV-governor.

D. Final test of pump with governor.

Test no. D1 and D2 applies with exception of speed and fuel delivery, the values of which are shown in the test schedules for separate engines. The whole of section D only applies to industrial engines in installations similar to those in trucks.

The **bottom output level framed** is equivalent to **continuous output** (100 %) and corresponds to the normal setting of the separate engine.

This implies a reduced rating of about 10 % from the basic output and is denoted with the code letter z in column 2 for output code. The type designation of the pump will thus be PE6P110A720RS3014z, which must be unconditionally indicated on the type plate.

Both the framed output levels described above normally correspond to both the output curves in the engine diagram, which apply when selling the engine.

The standard necessary is indicated in the engine diagram for determining which engine output is to be applied, together with appropriate tolerance. The various different output levels, which are specified in the test schedules, indicate deviations from the engine basic output according to above and are defined by the **output code** in column 2.

Explanation of various terms

The CRO-values in column 1 only show how much CRO is to be decreased or increased from the **basic setting** in order that desired output level shall be attained.

Under the heading "Governor" in the example chosen is indicated

Δn = 4 % in code z. (Δn is pronounced "delta n")

Δn is the remaining speed droop since the engine speed after rapid load drop has stabilized itself. It is calculated here in per cent of the engines highest full load speed.

If the highest full load speed of the engine n_a = 1500 r/min and high idling n_b = 1560 r/min, the speed droop will be 60 r/min, i.e.

$$\Delta n = \frac{60 \times 100}{1500} = 4\ \%$$

At output levels exceeding z (= above z in the tables) the speed droop Δn will be more than 4 %.

At output levels below z (= below z in the tables) the speed droop will be less than 4 %.

For **generator operation,** where normally only Bosch RSV governor is used, it is necessary to ensure that the speed at high idling shall be 1554 – 1560 r/min at frequency 50 Hz and equivalent, i.e. 1865 – 1872 r/min at 60 Hz.

At n_a= 2100 r/min similar values apply.

To get the above values for the speed droop Δn, when testing the engine, the governor is pre-set in the pump bench so, that the so-called **specific speed droop c** gets a certain value, which is indicated at the top in each table.

The term **specific speed droop** refers to the ratio between the speed droop in r/min and the corresponding change of control rod opening CRO, i.e.

$$\frac{\Delta n}{\Delta CRO}$$

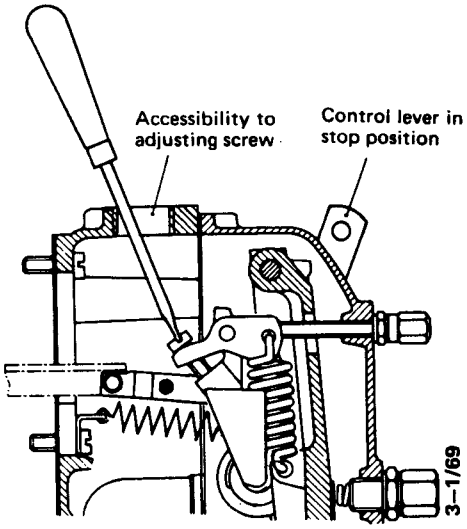
The way to calculate the value of c according to Bosch is shown by 3a AR 2 page 6.

When derating output for instance from output code z to m the remaining speed droop will **decrease,** while the specific speed droop is **constant,** as it characterizes the spring equipment and its pre-setting (higher value of c corresponds to more rigid springs).

The position of the speed lever against full speed stop is indicated by angle v in degrees in column 6 etc.. Initial point is from v = 40^{o}, when the speed lever is parallel with the parting line between governor and pump housing.

The **prestressing** of the governor spring can be adjusted with an appropriate so-called x - value, which is indicated in the tabel heading immediately following the c - value.

The figure shows how the adjusting screw for x - value can be reached with a screwdriver from above by putting the speed lever in stop position (below low speed position).



An adjusting screw fully screwed in is equivalent to x=0. x=1 means that the adjusting screw is screwed out (turning anti-clockwise) 1 turn =4 clicks. The normally max. permissible amount of unscrewing is x=6, i.e. 24 clicks or 6 complete turns.

Example: x=2.25 means 2 1/4 turns unscrewing the adjusting screw.

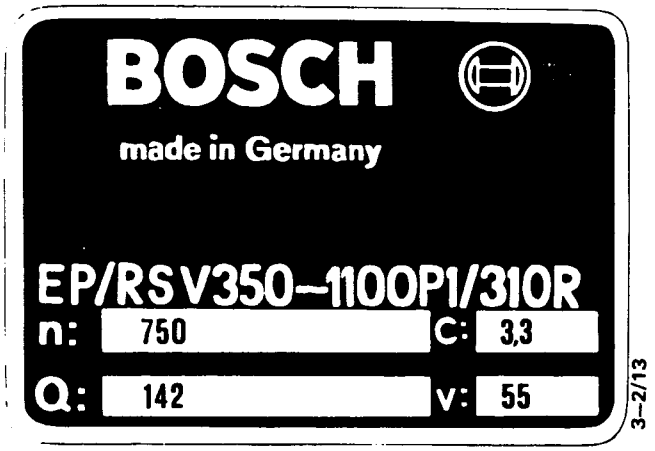
N:B: The table value for x only constitutes an approximate value as aid in order to speedily obtain the correct setting of the speed droop. On Bosch variable range speed governor of type EP/RSV (popularly termed "RSV governor") there is a so-called variant plate, which shows the deviation from the basic setting. This may be in different designs.

n=750 is the speed of the pump in the pump test bench, i.e. half of the engines max. full load speed n_a=1500 r/min.

Q=142 is the fuel delivery in mm^3/stroke when running in Bosch pump test bench at 750 r/min.

c=3.3 is the specific speed droop.

v=55 is the full speed position of the speed lever. The angle varies somewhat for different output levels.



The engine output N_e is partly indicated in kilowatt, kW, and partly in metric horsepower (column 3 and 4 etc.).

Measures after test running

After each test run the variant plate is checked to see that it is marked with the values, conforming with those in the test table. In the event of the setting being altered in any way, the plate must be unconditionally remarked or changed so that it always shows the true injection pump setting.

Check that the type plate of pump has the correct output code.

SP

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type Engine Design.	Injection Pump	Governor
D8 A04, A06	Bosch PE6P110A720RS261	RQV200–1200PA170R
Equip. etc. see test table 3aSP13 p.17 ed.2		Δn = 6-12 % at Code –

Basic Values		Table n_a = 2400					Table n_a = 2000					Table n_a =				
CRO mm	Output Code	N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12,0 ± 0,5	–	114	155	92			104	142	92							
– 0,7	x	108	147	86			98	134	85							
– 1,2	z	103	140	82			93	126	81							
– 1,7	n	97	132	78			88	119	76							
– 2,3	m	91	124	73			82	111	69							
– 2,8	l	85	116	68			76	103	64							
– 3,3	k	79	108	62			68	93	58							
– 3,6	j	74	101	58			63	86	55							
– 3,9	i	68	93	53			57	78	51							

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
D8	A04, A06, M01, M02	Bosch PE6P110A720RS261	EP/RSV250–1200P1/310R
Equip. etc. see test table 3aSP13p.17 ed.2			Δn = 4 % at Code z

Basic Values		Table n_e = 1500 c=4.4 x≈2.75					Table n_e = 1800 c=4.4 x≈3.5					Table n_e =				
CRO mm	Output Code	N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12,0 ± 0,5	–	79	107	90	35		93	127	91	44						
– 0,7	x	75	102	81			89	121	84							
– 1,2	z	71	97	74	35		84	115	78	44						
– 1,7	n	67	91	67			79	108	73							
– 2,3	m	61	83	60			74	100	66							
– 2,8	l	54	74	55			67	91	60							
– 3,3	k	48	65	49			60	82	55							
– 3,6	j	43	58	47			54	74	52							
– 3,9	i	38	52	44			49	67	49							

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type Engine Design.	Injection Pump	Governor
D8 M01, M02	Bosch PE6P110A720RS261	EP/RSV350–1200P1/310R
Equip. etc. see test table 3aSP13 p.17 ed.2		Δn = 10 % at Code z

Basic Values		Table n_a = 2000					Table n_a =					Table n_a =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12,0 ± 0,5	–	104	142	92	62											
– 1,2	z	93	126	81												

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
DS8	A02, A05, M01	Bosch PE6P110A720RS3013	EP/RSV350–1200P1/310R
Equip. etc. see test table 3a SP 14 p.9 ed. 2			Δn = 4 % at Code z

Basic Values		Table n_e = 1500 c=3.5 x≈2.25					Table n_e = 1800 c=3.5 x≈3					Table n_e =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,3	t	111	151	121	35		131	178	121	42						
12,0 ± 0,5	–	106	144	115	35		126	171	116	42						
– 0,2	s	103	140	111			123	167	112							
– 0,5	x	100	136	105			118	161	108							
– 0,7	q	97	132	102			115	157	105							
– 1,0	z	96	130	97	34		114	155	101	42						
– 1,2	o	93	127	94			110	149	98							
– 1,5	n	91	124	90			104	141	95							
– 1,9	m	82	112	83			98	133	89							
– 2,3	l	77	105	77			92	125	84							
– 2,8	k	71	96	69			85	116	77							
– 3,1	j	68	92	66			81	110	74							
– 3,5	i	63	86	61			76	103	70							

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
DS8	M01	Bosch PE6P110720RS3013	EP/RSV350–1200P1/310R
Equip. etc. see test table 3a SP14 p.9 ed.2			Δn = 10 % at Code z

Basic Values		Table n_a = 2000 c=8.6 x≈6					Table n_a =					Table n_a =				
CRO mm	Output Code	N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,3	t	145	197	121												
12,0 ± 0,5	–	140	190	116	60											
– 0,2	s	136	185	112												
– 0,5	x	132	179	108												
– 0,7	q	129	175	105												
– 1,0	z	126	171	101	60											
– 1,2	o	121	164	98												
– 1,5	n	116	158	95												
– 1,9	m	109	148	89												
– 2,3	l	102	139	84												
– 2,8	k	95	129	77												
– 3,1	j	90	122	74												
– 3,5	i	85	115	70												

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
D11	A05, A06, A07	Bosch PE6P110A720RS3005	RQV250–1100PA183R
Equip.etc. see test table 3aSP15 p.14 ed.2			Δn = 6-12 % at Code

Basic Values		Table n_a = 2200					Table n_a = 2000					Table n_a =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,2	t	162	220	140			154	209	139							
12,5 ±0,5	–	158	215	138			149	203	137							
– 0,5	x	150	204	128			142	193	126							
– 0,7	q	147	200	124			139	189	123							
– 1,0	z	142	193	119			135	183	117							
– 1,2	o	139	189	116			132	179	113							
– 1,4	n	135	183	113			127	173	110							
– 1,7	m	127	172	108			119	162	105							
– 2,1	l	118	161	101			112	152	98							
– 2,5	k	110	150	96			104	142	92							
– 2,8	j	103	140	91			97	132	88							
– 3,3	i	95	129	85			90	122	82							

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
D11	A05, A06, A07	Bosch PE6P110A720RS3005	EP/RSV350–1100P1/3105
Equip.etc. see test table 3aSP15 p.14 ed.2			Δn = 4 % at Code z

Basic Values		Table n_a = 1500 c= 3,7 x≈ 2,5					Table n_a = 1800 c= 3,7 x ≈ 3					Table n_a =				
CRO mm	Output Code	N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,2	t	124	169	141			142	193	139							
12,5 ± 0,5	–	118	161	139	34		136	185	137	42						
– 0,5	x	112	153	128			132	179	126							
– 0,7	q	110	150	123			127	173	123							
– 1,0	z	106	145	117	34		123	167	117	42						
– 1,2	o	104	141	112			120	164	113							
– 1,4	n	102	139	108			118	161	109							
– 1,7	m	96	131	101			112	152	104							
– 2,1	l	89	121	93			104	142	97							
– 2,5	k	82	112	86			97	132	91							
– 2,8	j	75	102	80			89	121	87							
– 3,3	i	68	93	73			82	111	80							

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
D11	M01	Bosch PE6P110A720RS3005	EP/RSV350–1100P1/310R
Equip.etc. see test table 3aSP15 p.14 ed.2			Δn = 4 % at Code z

Basic Values		Table n_a = 1500 c = 3,7 x ≈ 2,5					Table n_a = 1800 c= 3,7 x≈ 3					Table n_a =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12,5 ± 0,5	–	118	161	139	34		136	185	137	42						
– 1,0	z	106	145	117	34		123	167	117	42						

3200-1063

Date of Issue	
77-10-15	

SERVICE SCANIA

Group	Section	Number	Page
3c	SP	6	4
Date of Validity			Edition
76-02-20			1

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
D11	M01	Bosch PE6P110A720RS3005	EP/RSV350–1100P1/310R
Equip.etc. see test table 3aSP15 p.14 ed. 2			Δn = 10 % at Code z

Basic Values		Table n_a = 2000 c = 9,1					Table n_e =					Table n_e =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,2	t	154	209	139												
12,5 ± 0,5	–	149	203	137												
– 0,5	x	143	194	127												
– 0,7	q	139	189	123												
– 1,0	z	134	182	118												
– 1,2	o	132	180	114												
– 1,4	n	128	174	110												
– 1,7	m	121	165	106												
– 2,1	l	113	154	99												
– 2,5	k	106	144	93												
– 2,8	j	98	133	90												
– 3,3	i	90	122	83												

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
D11	A04	CAV P5338	GMVZN250/1100S77
Equip.etc. see test table 3aSP15 p.16 ed.2			Δn = 6-12 % at Code z

Basic Values		Table n_a = 2200					Table n_a = 2000					Table n_a =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
12,5 ± 0,5	–	143	195	120			137	186	121							
– 0,5	x	136	185	106			130	177	107							
– 0,7	q	133	181	101			127	173	103							
– 1,0	z	130	176	97			123	167	98							
– 1,2	o	127	172	93			120	163	93							
– 1,4	n	122	166	87			115	156	87							
– 1,7	m	115	156	77			108	147	76							
– 2,1	l	107	146	69			100	137	67							
– 2,5	k	101	137	64			93	127	62							
– 2,8	j	93	127	60			88	119	58							
– 3,3	i	86	117	57			80	109	54							

3200-1063

Date of Issue	
77-10-15	

SERVICE SCANIA

Group	Section	Number	Page
3c	SP	7	1
Date of Validity			Edition
75-12-19			1

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
DS11	A05, A06, A07	Bosch PE6P110A720RS3006	RQV250–1100PA242R
Equip.etc. see test table 3aSP16 p.9 ed.2			Δn = 6-12 % at Code –

Basic Values		Table n_a = 2200					Table n_a =					Table n_a =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,3	t	220	299	170												
13,0 ± 0,5	–	213	290	164												
– 0,2	s	209	284	160												
– 0,4	x	203	276	154												
– 0,6	q	198	270	150												
– 0,8	z	192	261	145												
– 1,0	o	188	255	141												
– 1,3	n	181	246	135												
– 1,7	m	171	232	126												
– 2,1	l	160	218	118												
– 2,5	k	149	203	110												
– 2,9	j	139	188	103												
– 3,4	i	128	174	96												

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
DS11	A05, A06, A07, M01	Bosch PE6P110A720RS3014	EP/RSV350–1100R1/310R
Equip.etc. see test table 3aSP16 p.9 ed.6			Δn = 4 % at Code z

Basic Values		Table n_a = 1500 c = 3,9 x ≈ 2,25					Table n_a = 1800 c= 3,9 x ≈ 2,75					Table n_a = 2100 c = 3,9 x ≈ 3,75				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,3	t	172	234	169			196	266	170			212	288	171		
13,0 ± 0,5	–	165	225	164	34		188	256	166	41,5		205	279	165	51,5	
– 0,2	s	162	220	161			186	253	162			200	272	161		
– 0,4	x	159	216	156			182	248	157			195	265	155		
– 0,6	q	155	211	153			178	242	154			190	258	151		
– 0,8	z	150	204	149	34		171	233	149	41		185	252	147	51	
– 1,0	o	146	198	145			168	228	145			180	245	142		
– 1,3	n	142	193	139			162	220	137			174	237	136		
– 1,7	m	135	184	130			154	209	128			163	222	126		
– 2,1	l	124	169	120			143	194	118			152	207	117		
– 2,5	k	115	156	108			132	180	109			142	193	109		
– 2,9	j	107	145	99			123	167	100			132	180	102		
– 3,4	i	98	133	91	33,5		114	155	93	41		121	165	95	50,5	

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
DS11	M01	Bosch PE6P110A720RS3014	EP/RSV350–1100P1/310R
Equip.etc. see test table 3aSP16 p.9 ed.6			Δn = 10 % at Code z

Basic Values		Table n_a = 1800 c= 9,7 x ≈6					Table n_a =					Table n_a =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
13,0 ± 0,5	–	193	262	166	56											
– 0,8	z	174	236	149	55											

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
DSI11	R82A	Bosch PE6P100A720RS203,–RS146	EP/RSV350–1100R1/310R
Equip.etc. see test table 3aSP16 p.6 ed.2			Δn = 4 % at Code z

Basic Values		Table n_a = 1500 c= 3,3 x ≈ 2,25					Table n_a = 1800 c = 3,3 x ≈ 3					Table n_a =				
		N_e					N_e					N_e				
CRO mm	Output Code	kW	hp	Q	v		kW	hp	Q	v		kW	hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,5	y	158	215	174	38		182	247	172	43						
14,5 ± 0,5	–	142	193	164	35		166	226	163	42						
–1,0	z															

1) Stroke pos. 2.40 + 0.10

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type Engine Design	Injection Pump	Governor
DSI11 R82A	Bosch PE6P100A720RS203	EP/RSV350–1100P1/310R
Equip.etc. see test table 3aSP16 p.6 ed.2		Δn = 10% at Code z

Basic Values		Table n_a = 1800					Table n_a =					Table n_a =				
CRO mm	Output Code	N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 0,7	v	191	260	176												
+ 0,5	y	185	252	172	57											
	t															
14,5 ± 0,5	–	175	238	163												
– 0,2	s	171	233	159												
– 0,5	x	166	226	154												
– 0,7	q	162	220	150												
– 1,0	z	157	214	145	56											

1) Stroke pos. 2.40 + 0.10

3200-1063

TEST SCHEDULE – Injection Pump for Separate Engines

Engine Type	Engine Design	Injection Pump	Governor
DSI11	M01	Boshc PE6P110A720RS3016,–RS3014	EP/RSV350-1100P1/310R
Equip.etc. see test table 3aSP16 p.9 ed.6			Δn = 4 % at Code z

Basic Values		Table n_a = 1500 c = 3,9 x ≈ 2,25					Table n_a = 1800 c = 3,9 x ≈ 2,75					Table n_a =				
CRO mm	Output Code	N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v		N_e kW	N_e hp	Q	v	
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
+ 2,1	p	206	280	205	34,5		235	320	205	42						
+ 1,4	r	191	260	187			217	295	188							
+ 1,0	w	185	251	181			210	285	181							
+ 0,5	y	176	239	173			199	271	174							
∓ 0,3	t	172	234	169			196	266	170							
13,0 ± 0,5	–	165	225	164	34		188	256	166	41,5						
– 0,2	s	162	220	160			186	253	162							
– 0,4	x	159	216	156			182	248	157							
– 0,6	q	155	211	153			178	242	154							
– 0,8	z	150	204	149	34		171	233	149	41						
– 1,0	o	146	198	145			168	228	145							
– 1,3	n	142	193	139			162	220	137							
– 1,7	m	135	184	130			154	209	128							
– 2,1	l	124	169	120			143	194	118							
– 2,5	k	115	156	109			132	180	109							
– 2,9	j	107	145	99			123	167	100							
– 3,4	i	98	133	92	33,5		114	155	93	41						

3200-1063

BOSCH BALANCE SPRING GOVERNOR TYPE TYPE EP/RSV

General

The subject governor is now used on the D11-series engines in generating sets and multi-engine installations.

The advantage to be gained with this governor, being of the all-speed type, is that only **one** governor weight set and **one** governor spring are necessary in order to cover the demands so far on control characteristics. This can furthermore be adjusted in a simple manner, which is of extremely great importance when operating engines in parallel. The design is shown by the figure below:

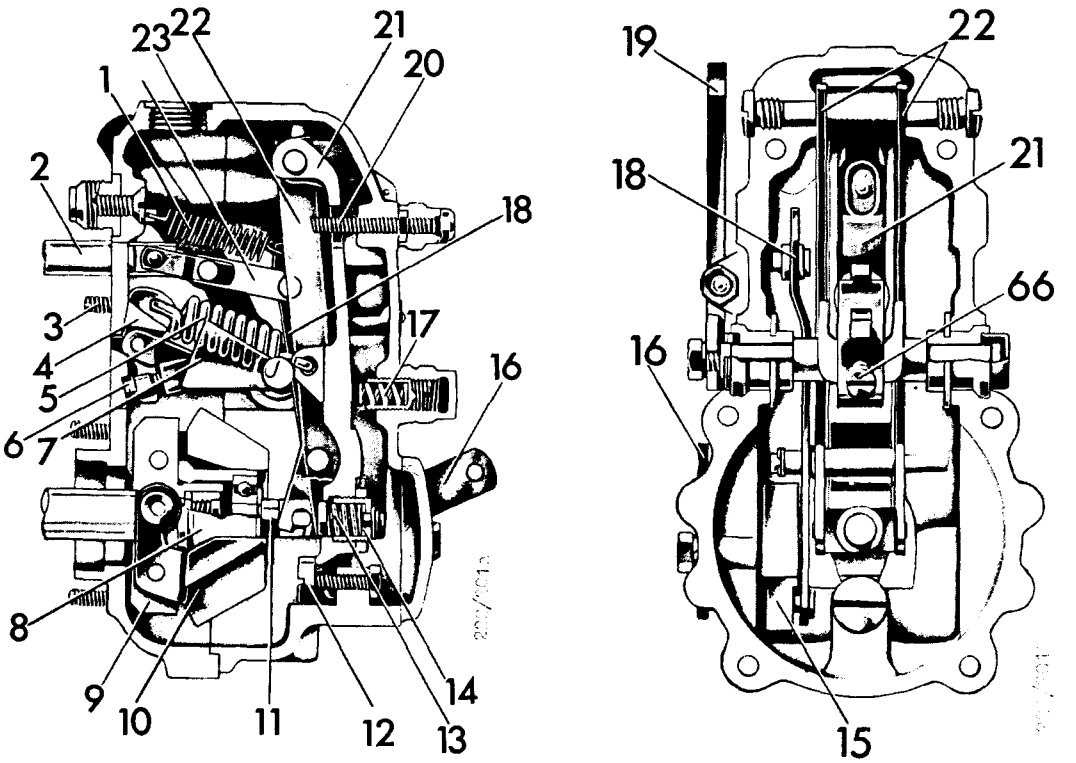


Fig. 1

Governor EP/RSV

1. Starting Spring
2. Control rod
3. Maximum speed stop
4. Rocker arm
5. Governor spring
6. Set screw
7. Balance arm
8. Governor sleeve
9. Governor hub
10. Governor weight
11. Driver pin
12. Internal full load stop
13. Equalizer spring
14. Adjusting washers
15. Stop device
16. Stop lever
17. Idling damper spring
18. Governor arm
19. Control arm
20. Idling stop
21. Tension arm
22. Guide arm
23. Screw plug

73.11498/3200-10.045

Functional Description

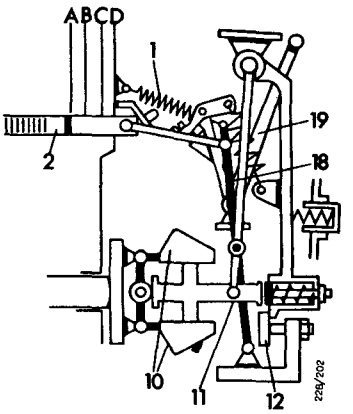


Fig. 2 Starting the engine

A = Control rod cold start position
B = " rod full load position
C = " rod position at high no-load speed
D = " rod zero position

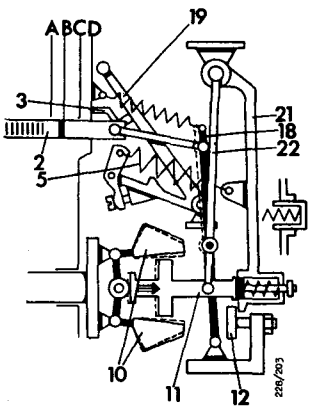


Fig. 3 Regulation at maximum full load speed

Starting the engine, fig. 2:

The starting spring (1) pulls the governor arm (18) and in conjunction with this, the control rod (2) towards the cold start position. When the engine has started, the governor weights (10) move outwards and push the driver pin (11) and the lower end of the guide arm to the right as in the figure. The guide arm in its turn activates the governor arm (18) and the control rod (2) so that control rod movement is reduced. N.B. when the engine is not operating, the control rod runs towards the cold start position or full load position, depending on governor type, see page 3, regardless of the position of the control arm (19).

Regulation at max. full load speed, Fig. 3:

The control arm (19) then bears against the maximum speed stop (3) and pulls, through the governor spring (5), the tension arm (21) towards the full load stop (12). If the speed is now increased further, which occurs when the load is reduced, the centrifugal force of the governor weights (10) overcomes the tension force of the governor spring (5) and pushes the driver pin (11) to the right. The driver pin in its turn activates the guide arm (22), which via the governor arm (18) pushes the control rod (2) to a smaller control rod opening, whereby the engine speed is restricted.

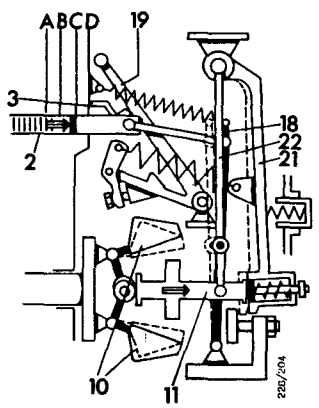


Fig. 4 High no-load speed

A= Control rod cold start position
B= " rod full load position
C= " rod position at no-load speed
D= " rod zero position

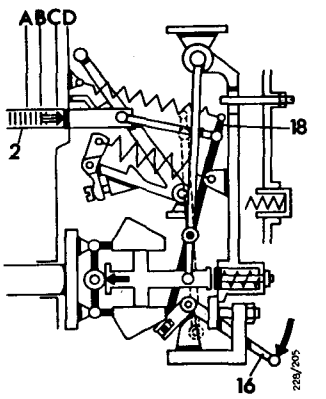


Fig. 5 Stopping the engine

High no-load speed (i.e. completely unloaded engine), Fig 4:

The control arm (19) bears against the maximum speed stop (3), and the centrifugal force from the governor weights (10) is now so great that the tension arm (21) is pushed farther to the right. The driver pin (11) activates the guide arm (22) and the governor arm (18), which pushes the control rod (2) to an even smaller control rod opening equivalent to the fuel quantity necessary in order to keep the engine rotating.

Stopping the engine, Fig. 5:

When the stop lever (16) is moved into the stop position, the governor arm (18) is activated so that its upper part moves to the right and pulls the control rod (2) towards zero. When the stop lever is released, it is moved back again by a return spring to the operating position.

Different Type Designs

The following two governor types have been used on the D11 series:

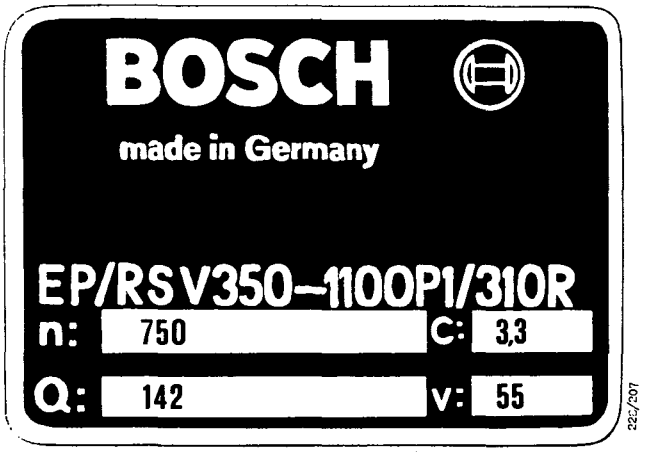
a) EP/RSV 350-1100 P1/307R

b) EP/RSV 350-1100 P1/310R

a) This governor type has so-called internal maximum load stop, i.e. the screw with which max. control rod opening is set is to be found inside the governor, see 12 in Fig. 1. This implies that the control rod always runs towards the cold start position when the engine has been stopped, see Fig, 2 and "Starting the Engine". If the "spill cut-off" method (Wilbär) is then used for setting the pump at its due degree marking, on the engine, a faulty setting will occur because of the cold start grooves in the pump elements. This can be avoided, if the stop lever is moved half way towards the stop position and kept there during the setting.

b) This governor type lacks the above described internal maximum load stop but has instead an external maximum load stop. The cold start device on the front edge of pump serves in this case as maximum load stop. When the weather is cold it is thus necessary to operate the cold start device.

Type Plate



On the governor casing is to be found the above plate, which in addition to the type, indicates the values which the injection pump has been set at in conjunction with engine testing.

The below mentioned example will make it quite clear what the values refer to:

n: 750 Maximum load speed of injection pump on bench test.

Q:142 Fuel delivery in mm^3/stroke on bench test at a certain maximum load speed.

c:3.3 Specific speed increase of injection pump, defined as:

The speed difference between the maximum load speed of the injection pump and the speed at which the control rod opening has decreased by 6 mm from the control rod opening at maximum load, in percent of the maximum load speed. The control arm shall bear on the maximum speed stop.

Example

The maximum load speed of the pump = 750 r.p.m.
Maximum control rod opening equivalent to maximum load position = 13 mm.
Speed at 7 mm (= 13-6) control rod opening = 775 r.p.m.

$$c = \frac{(775-750) \cdot 100}{750} = 3.3\ \%$$

Note that the specific speed increase indicates the regulation characteristics and has no definite connection with the engine speed increase.

V:55 Maximum control arm angle, defined as $V = 40^{o}$ when the control arm is parallel with the parting line between the governor housing and the pump housing.

73.11498/3200-10.045

Setting and Adjustment

The necessary values for repairs or operating of governor on the test bench is shown by the Bosch repair and test instructions.

Particulars for calibrating the pump and setting maximum delivery are also indicated by us in a separate Service Bulletin.

Adjustment of the maximum load speed is effected with the maximum speed screw on the outside of governor housing.

The engine speed increase and thereby the high no-load speed are influenced foremost by the governor spring preload. The tensioning is performed by the set screw (6, Fig.1). It is possible to adjust this screw through the hole for the screw plug (23, Fig. 1), if the control arm is moved backwards, see Fig. 2. In certain cases, it will also be necessary to screw out the idling stop (20, Fig. 2).

Turning clockwise results in higher tension and smaller speed increase. The control arm angle must then be diminished to maintain the same maximum load speed. Inversely, a re-setting of the control arm position will also modify somewhat the preload of the governor spring.

The procedure when re-setting the maximum fuel delivery or maximum control rod opening is shown in the above section about different type designs.
Re-setting the maximum fuel delivery also influences somewhat the maximum load speed and the speed increase.

The idling speed is set with screw (20, Fig. 1). The idling damper spring (17, Fig. 1) prevents engine stalling and permits an even transition to low no-load speed. It must not be screwed in too far that it increases the high no-load speed.

HARWOOD WATER SEPARATOR

In some separate engine installations difficulties arise on account of water entering the fuel. If water does penetrate into the fuel lines and accompanies the fuel right to the injection equipment serious operational disturbances are likely to occur including possible engine stop. In certain situations damage may be caused to the injection equipment through corrosion.

To avoid this from happening a water separator should be connected in between the fuel tank and the feed pump. Our Engine Sales Dept. is now in a position to supply one of these as extra equipment.

Function

The fuel flows in tangentially at (10) and receives a rotating movement round the cone (3). Any possible water in the fuel is forced out by the centrifugal force against the walls and drops down and is collected beneath the float (6). The waterless fuel is then sucked to the engine from the bottom side of the cone (3). At (2) there is a tiny hole which lets out the air.

The volume and weight of the float (6) are so adapted that it sinks in diesel oil but floats on water.

On the float there is a permanent magnet (7). When the float, on account of the water in the separator, has risen to a stage corresponding to about 0,3 dm^3 (litres) water, the contact (reed relay) (5) is activated by the permanent magnet. The current circuit is closed and an indicator lamp lights up. The water should then be drained out of the water separator as soon as possible (See maintenance).

If the fuel tank contains too much water there is a risk with ships engines, particularly when on a choppy sea, that a considerable amount of water will suddenly be drawn into the fuel system. To avoid this water from being drawn into the injection equipment there is a valve located (4), which shuts off the flow of fuel when the water separator contains about 1,0 dm^3 (litre) water. The attached engine then stops before the water penetrates into the injection equipment.

In the valve jams by reason of the remaining underpressure in the line to the feed pump, the valve is released by pressing button (1).

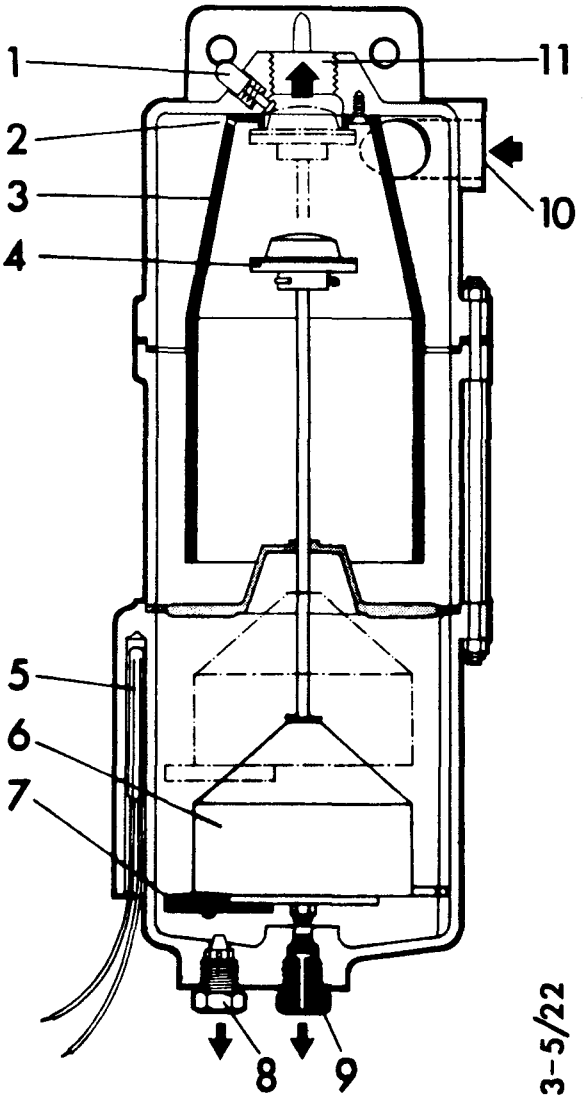


Fig 1

Cut-away section of the water separator

1. *Button to open valve*
2. *Air hole*
3. *Inlet cone*
4. *Valve for shutting off fuel flow*
5. *Electric contact*
6. *Float*
7. *Permanent magnet*
8. *Drainage plug*
9. *Drainage plug*
10. *Inlet*
11. *Outlet*

SI

SE, SH

In some installations (e.g. emergency unit and propeller operation with one engine) it may be unsuitable for the engine to be stopped this way. To avoid this the valve can be kept in open position by securing the button (1) in pressed in position. To achieve this the material round the button (pressed in position) is slightly up-set by using a hammer or similar.

In this type of water separator the drainage plug (9) has no function, so there is no need to use it.

Build-in

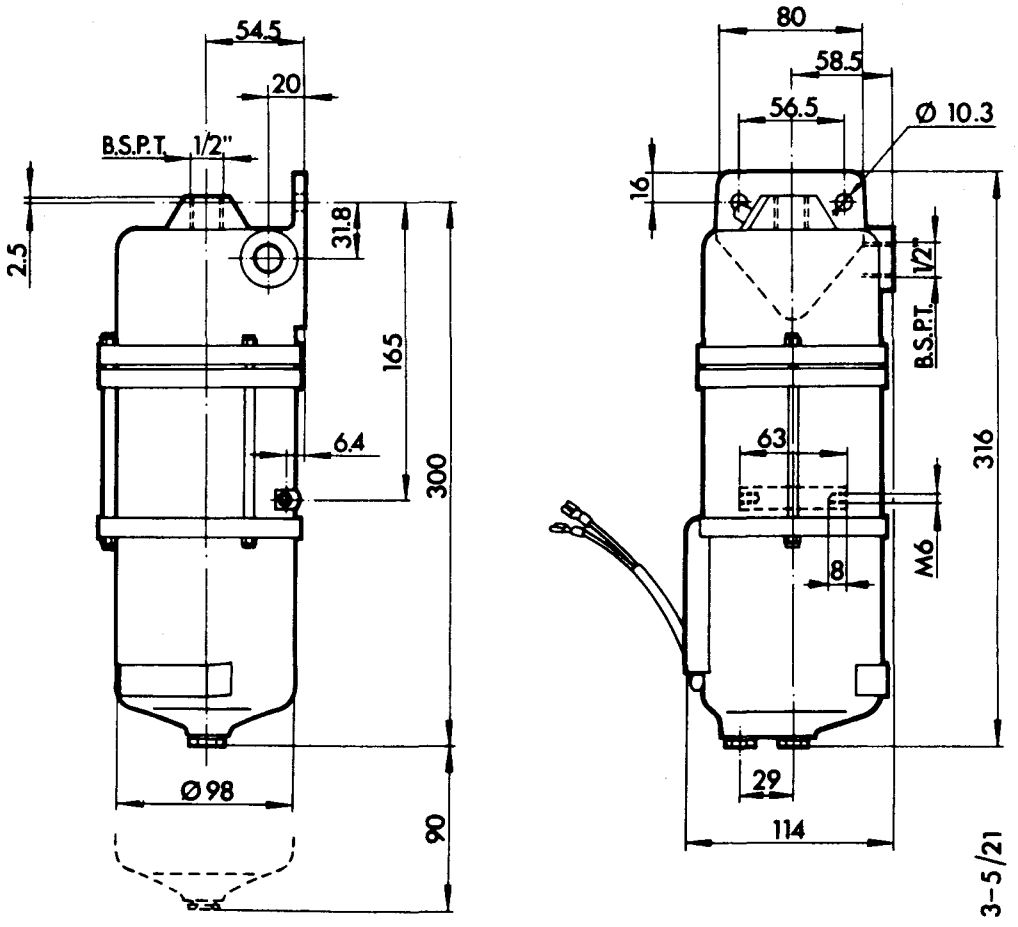


Fig 2 The build-in measurements of the water separator

The water separator is to be fitted vertically and in such a way that it is subjected only to the most fractional vibrations. It is fixed in the two threaded holes (Ø 10,3) and is supported with the two threaded holes (M6) in the middle part. The water separator is connected to the suction line between the fuel tank and the feed pump, as close to the fuel tank as possible. Connecting up should take place according to fig. 3 or fig. 4. Only one engine should be connected to each water separator. The flow of fuel through the separator is to be max. 405 dm^3/h (litre/h).

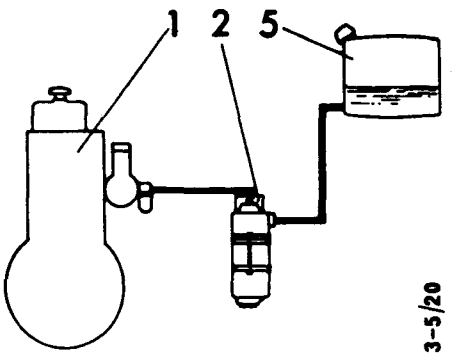


Fig 3

Water separator and engine are located beneath the fuel tank

1. Engine
2. Water separator
5. Fuel tank

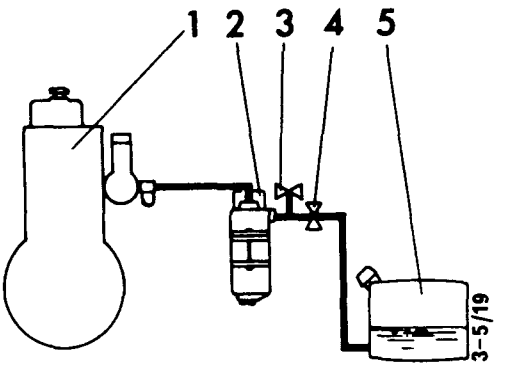


Fig 4

Water separator and engine are located above the fuel tank

1. Engine
2. Water separator
3. Air valve
4. Shut-off valve
5. Fuel tank

In order to be able to remove the bottom part of the water separator it is necessary to have a space of 90 mm beneath the separator.

Electrical Connection

Breaking capacity of the contact 2A (however, max. 25W)

The water separator is provided with an open contact, which closes when the water has risen to a certain level. Connection is made to a warning lamp. When using an original electric system for our engines the water separator should be connected to the warning lamp "Service".

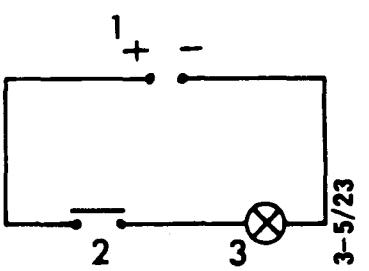


Fig 5

Electrical connection

1. Voltage source
2. Open contact of water separator
3. Warning lamp (max. 25W)

Maintenance

When the warning lamp for the water separator lights up the water shall be drained out as quickly as possible. This takes place according to the following.

A. In installation according to fig. 3

1. Stop the engine
2. Remove the plug (8 fig. 1) on the side of the bottom part of the separator and drain out the water.
3. Fit the plug

B. In installation according to fig. 4

1. Stop the engine
2. Close the shut-off valve (4)
3. Remove the plug (8 fig.1) on the bottom side of the separator
4. Open the air valve (3 fig. 4) and drain out the water
5. Fit the plug
6. Close the air valve
7. Open the shut-off valve
8. Bleed the fuel system

When the engine has stopped by reason of the water separator valve stopping the flow of fuel, it may so happen that the valve will remain closed even after the water has been drained out. This becomes evident when the separator warning lamp does not go out. In which case the valve can be released by pressing in the button (1 fig. 1) on the top side of the separator.

Depending on the amount of impurities in the fuel, it may be convenient once or twice a year to remove the bottom part for cleaning purposes. **Make quite certain when fitting that the magnet on the float is turned facing the contact,** i. e. towards the side where the electric cables are joined up. Otherwise the warning lamp will not function. The sealing surfaces should when assembling be smeared with oil-resistant sealing compound.

Checking

The function of the warning lamp can be checked by holding a magnet against the projecting part of the water separator's bottom section, where the electric cables are joined. The lamp shall then light up.

COMPRESSOR TU FLO 500

Functional check

With the compressor running, check whether there is any abnormal noise or any sign of oil or water leakage and carry out any necessary repairs. Significant oil leakage past the piston rings is usually revealed by such indications as the accumulation of abnormal quantities of waste oil in the wet reservoir and greater coking tendencies in the cylinder head.

At regular intervals (every 10.000 km or 6.000 miles), check that the charging time for the brake system is normal. At 1.250 compressor r.p.m. (approx. 2.000 engine r.p.m.), from 0 to 7.7 bar (kgf/cm^2) the charging time must be 3–4 min. for a reservoir volume of 150 litres. Check also that the compressor is relieved at the upper pressure limit of 7.7 bar (kgf/cm^2) and resumes charging at 6.7 bar (kgf/cm^2).

Reconditioning – Replacement System

Thorough inspection of the compressor is advisable as a preventive measure even if the compressor does not reveal any acute faults but has been in service for a long time. In this connection, a check should be made on the cylinder wear, on the basis of which it can be decided whether to carry out minor reconditioning or a complete overhaul. This inspection is recommended after a driving distance of about 180.000 km (108.000 miles). Attention of this kind may, however, be advisable after both shorter and longer distances, depending on the severity of the operating conditions.

In case of faults in the compressor calling for more extensive repair work, such as reboring of the cylinder, reconditioning of bearing seats, etc., we recommend replacement of the compressor by a factory-reconditioned unit.

Removal

a. Empty the compressed-air system by opening the drain cocks on the air receivers.

b. Empty the cooling system of the engine, which will also empty that of the compressor.

c. Remove the driver pin for the tachometer drive (applies only to D/DS14).

d. Detach the air, water and oil lines connected to the compressor.

e. Undo the compressor retaining screws and remove the compressor.

f. Detach the gearwheel of the compressor with the aid of a puller after having screwed off the stop nut. Collect the key so that it does not get lost.

Dismantling

Cleaning

Clean off oil and dirt from the outside of the compressor; use a suitable cleaning agent and, if necessary, a steel wire brush.

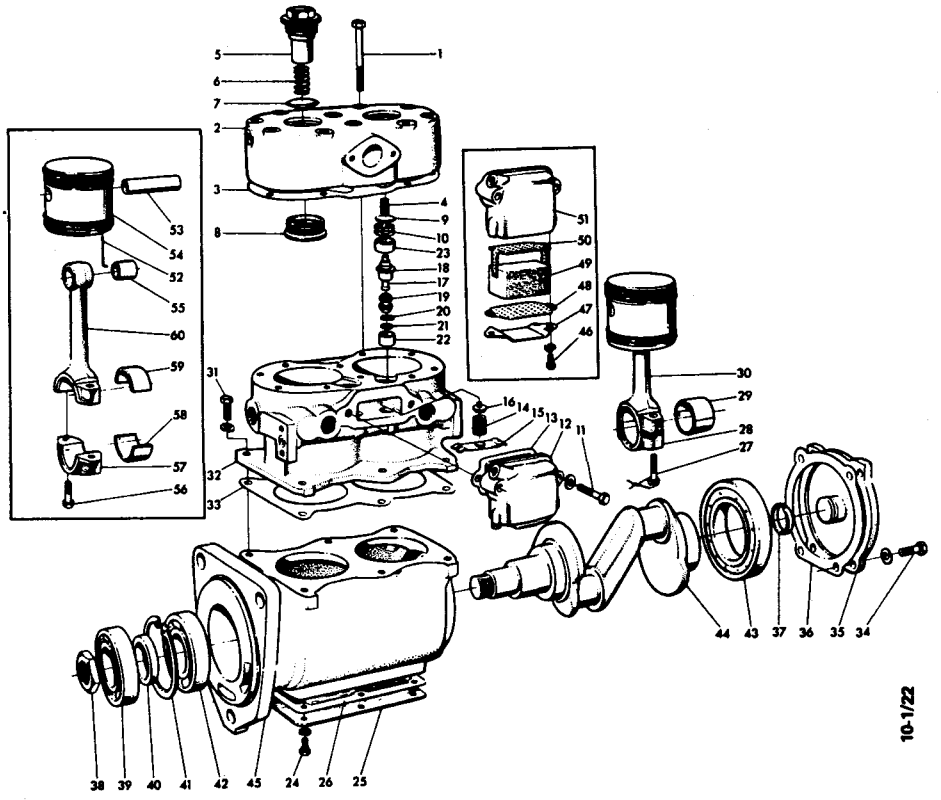
Marking

To facilitate subsequent reassembly of the compressor, the relative position of the following components should be marke before dismantling:

Cylinder block – crankcase; a punch pop, for example, can be used as the marking.

AB

75.16710/3200 – 10.333



1. *Screw*
2. *Cylinder head*
3. *Gasket*
4. *Valve spring*
5. *Valve spring retainer*
6. *Valve spring*
7. *Discharge valve*
8. *Discharge valve seat*
9. *Inlet valve*
10. *Valve guide*
11. *Screw*
12. *Air filter housing*
13. *Gasket*
14. *Spring*
15. *Relief saddle*
16. *Spring guide*
17. *Piston*
18. *Guide*
19. *Relief piston*
20. *Sealing ring*
21. *O-ring*
22. *Bushing*
23. *Valve seat*
24. *Screw*
25. *Bottom plate*
27. *Connecting-rod bolt*
28. *Connecting-rod cap*
29. *Big-end bearing*
30. *Piston with connecting rod*
31. *Screw*
32. *Cylinder block*
33. *Gasket*
34. *Screw*
35. *End cover*
36. *Gasket*
37. *Sealing ring*
38. *Nut*
39. *Ball bearing*
40. *Spacer*
41. *Lock ring*
42. *Ball bearing*
43. *Ball bearing*
44. *Crankshaft*
45. *Crankcase*
46. *Screw*
47. *Cover*
48. *Filter plate*
49. *Filter insert*
50. *Filter plate*
51. *Air filter housing*
52. *Wrist-pin retainer*
53. *Wrist pin*
54. *Piston*
55. *Bushing*
56. *Connecting rod bolt*
57. *Connecting rod cap*
58. *Bearing shell half*
59. *Bearing shell half*
60. *Connecting rod*

Fig. 1

Compressor TU FLO 500, exploded view

Dismantle the compressor in numerical order according to Fig. 1 and follow the directions given below.

14. Remove the relief spring with the aid of a screwdriver; when the spring has been raised slightly from its lower seat it can be taken out.

17–19. Apply a compressed-air nozzle to the connection hole for the pressure regulator and pass in compressed air – but do this cautiously.

27. First, check that the connecting-rod caps are marked, since in reassembling they must be placed in the same positions. The connecting rods should also be marked in relation to the corresponding crank pins so that they can be returned to the same crankpins in reassembling.

30. Press the pistons with connecting rods out of the cylinder block and refit the caps on their respective connecting rods.

38. Undo the nut and press the crankshaft out towards the rear (Fig. 2).

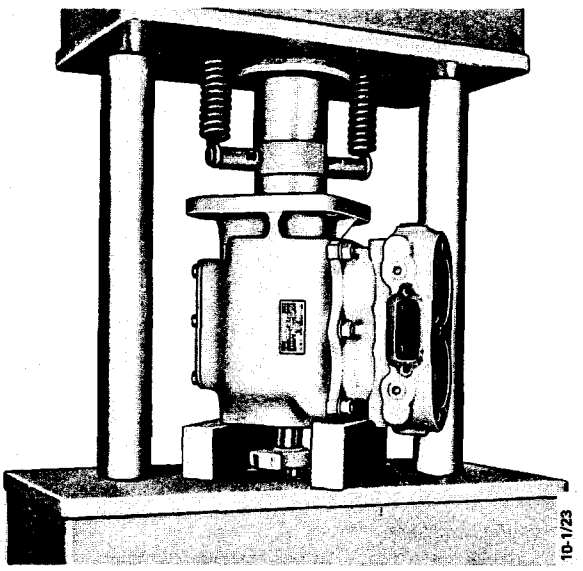


Fig. 2

Removal of chrankshaft

39–42. Press out the bearings when the crankshaft has been removed. Note the lock ring 41.

46–51. Remove the air filter for changing of the filter insert.

52–55. Remove the piston rings. **If the pistons or wrist-pin bushings are worn so much that they must be changed,** loosen the wrist-pin retainer and press the wrist-pins out.

Inspection and Replacement of Parts

Cylinder Head and Cylinder Block

Inspect the cylinder head and cylinder block for cracks or other damage. If any damage is found, change the affected parts.

Water Passages

Check the water jackets of the cylinder head and cylinder block for leaks. If leakage is suspected, assemble them temporarily and test the cooling system for leaks under pressure.

Inlet and Discharge Valves, Springs and Seats

Change all the valves and valve springs. If the valve seats are worn they must also be changed. Unscrew the seats of the discharge valves with a hexagon wrench. The seats of the inlet valves can be removed with an expander puller.

The easiest way to remove the inlet valve seat is to tap it, using an M14 threadcutting tap, and then to pull it off with the aid of a screw. A sleeve can be used as a spacer between screw head and cylinder.

Check that the valve travel of the discharge valves is sufficient. With new discharge valves, valve springs and screw plugs it must be possible to raise each valve 1.40–1.80 mm (0.056–0.070").

Check that the perpendicular distance from the upper face of the cylinder block to the plane of the seat of the inlet valve is not greater that 3.70 mm (0.145"). When a new valve seat has been fitted, the distance should be 2.55–2.85 mm (0.101–0.113").

Rear-End Cover on Crankcase

Discard used seals in the cover and fit new ones in their place. Check also that the sealing surfaces of the cover are flawless. If the sealing groove in the cover is appreciably worn the cover should be changed. Check also that the ring gap is 0.20–0.38 mm (0.008–0.015"); position the sealing ring on the end of the crankshaft, the sealing surface of which must also be without defects, and measure with a feeler gauge.

Bearing Seats for Crankshaft in Crankcase

Check that the bearing seats and the rest of the crankcase are intact. If, for instance, a bearing has crept in its seat or if the latter is enlarged by wear, the crankcase must be changed. The bearings should have a light press fit in the crankcase.

Sealing Surfaces

Check that all sealing surfaces (between cylinder head and cylinder block, cylinder block and crankcase, air filter and cylinder block, etc.) are plane so that effective sealing is obtained.

75.16710/3200– 10.333

Relief Mechanism

Check, among other things, the relief pistons and their cylinder bores in the cylinder block for wear. The bores must not be scored or damaged in any way that could cause leakage and accelerate wear on the seals. If such damage is found, or where there is considerable wear, the bushing should be changed. To change bushings, first tap them with an M10 thread-cutting tap and then pull them off with the aid of a screw and a sleeve.

Fit new seals on the relief pistons and lubricate them thoroughly with a heatresistant special grease (order No. 246746). Check that the return spring of the relief mechanism has sufficient tension to return the relief pistons to their rest position.

Cylinder Bores

Check the cylinder bores for wear, ovality or other damage (see Fig. 3). Cylinder bores that are scored or out of round by more than 0.05 mm (0.002"), or tapered more than 0.08 mm (0.003"), should be rebored or ground to oversize. Oversize pistons are available for 0.010", 0.020" and 0.030". The clearance between the piston and the cylinder bore should be 0.05–0.10 mm (0.002–0.004"). Final grinding of the cylinder bores should be carried out with the cylinder block mounted on the crankcase.

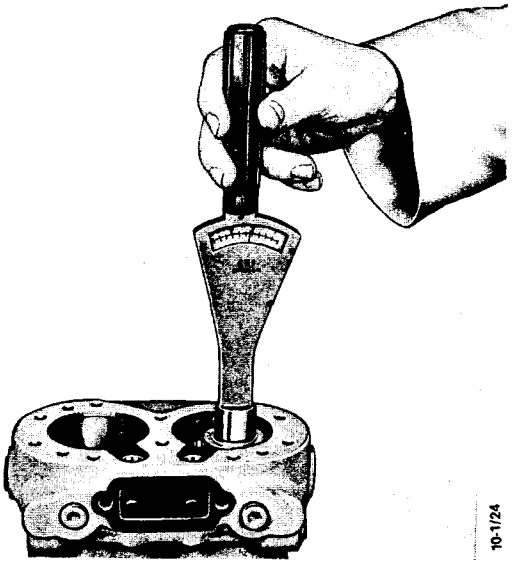


Fig. 3

Checking cylinder wear

Pistons

Examine the pistons for wear, scorings or other damage and change them if necessary. Check the piston wear with the aid of a micrometer; as stated above the piston clearance must be 0.05–0.10 mm (0.002–0.004") in relation to the existing cylinder diameter.

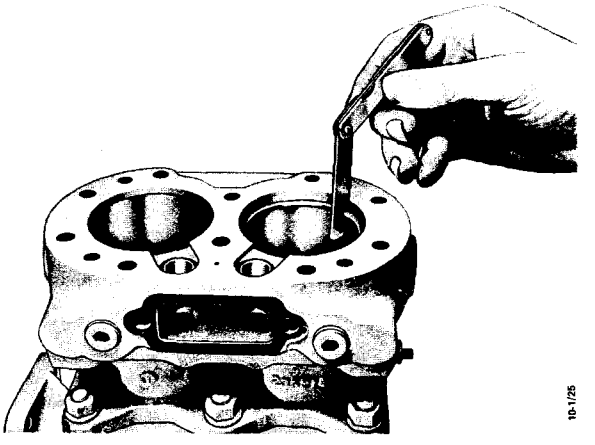


Fig. 4

Checking ring gap

Piston Rings

Check the fit of the piston rings in the ring grooves. Check also the ring gap with the rings fitted in the cylinder bore (see Fig. 4). The correct gap and clearance is shown in Fig. 5.

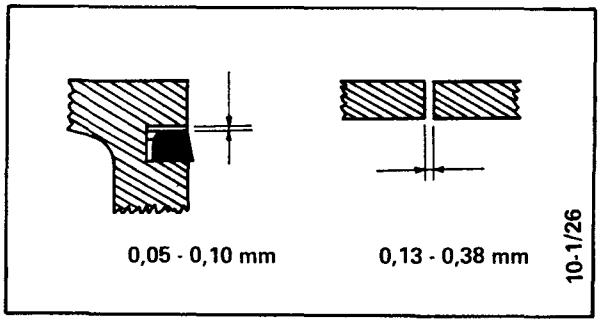


Fig. 5

Clearance and ring gap

Wrist Pins

Check the fit of the wrist pins in the pistons and connecting rods. They must have a light press fit in the pistons and if the pin is too loose either the wrist pin, the piston or both these items must be changed. The wrist pin must obviously float in the connecting-rod bushing, but the clearance should not exceed 0.04 mm (0.0015"). If the clearance exceeds this, the wrist-pin bushing should be changed. The new wrist-pin bushing must be pressed into place and then reamed to give a wrist-pin clearance of 0.003–0.015 mm (0.0001–0.0006"). After pressing it in, check that the lubricating hole in the bushing is directly opposite the corresponding hole in the connecting rod. Always discard used wrist-pin retainers and replace them by new ones.

Big-end Bearings, Crankshaft and Main Bearings

Check the big-end bearings for wear. If the bearing shells are worn or damaged they must be changed. If the crankshaft shows appreciable wear, so that it needs to be ground, undersize bearings should be fitted. Also check that the seating surface of the bearing shells in the connecting rod is free of defects. The clearance between the crankpin and the big-end bearing must not be less than 0.008 mm (0.0003") or more than 0.053 mm (0.0021"). Crankpins with an ovality of more than 0.025 mm (0.01") must be reground. In grinding, note that the same fillet radius must be preserved. Threads, keyways, etc., or the sealing surfaces of the crankshaft against the end covers must not be damaged or worn. Check the main bearings and renew them if they are worn or show other signs of damage.

Note

Big-end bearings are available as spare parts in the following undersizes: 0.010", 0.020" and 0.030".

Assembly

Assemble the compressor in the opposite order to dismantling, paying careful attention to the directions given below. Use new gaskets only.

55–52. Lubricate the **wrist-pin bushing** with clean engine oil and fit the piston to the connecting rod. Before pressing the wrist pin in, turn it so that its hole for the locking wire coincides with that of the piston. If a relatively large press force is required to fit the pin, check with a micrometer that the piston has not been deformed. Lock the wrist pin with a new wrist-pin retainer. Do not use pistons in which the wrist pin has a loose fit.

Fit the **piston rings;** turn the "top" marking to face upwards. This is important in view of the conical shape of the rings. Locate the rings so that their gaps do not come one below the other but are distributed round the piston. The oil scraper ring must be located in the ring groove immediately above the wrist pin.

44–38. Check that the main bearings are properly pressed in against the shoulder on the crankshaft. Lubricate the bearings, too, with engine oil. Press the crankshaft in carefully far enough for the bearings to resume their original positions in relation to the end cover of the crankcase.

34. Tightening torque: 1.8 kgf m.

31. Tightening torque: 4.0 kgf m.

30–27. Fit the pistons and connecting rods into the cylinder block. First, detach the cap on the connecting rod which is to be inserted and turn the crankshaft so that the crankpin concerned faces downwards. Check that the cylinder bores and crankpins are clean and make sure that the connecting rod is fitted on the same crankpin as before. Then refit the bearing cap in accordance with the marking made earlier on in relation to the connecting rod. As a rule, the caps must be arranged so that the grooves for the bearing shells in the connecting rod and cap respectively come adjacent to the same connecting-rod bolt. Tightening torque: 1.8 kgf m. Lock the connecting-rod bolts with locking plate.

75.16710/3200 – 10.333

19–17. Make sure that the relief pistons and piston seals are lubricated with special grease (order No. 246746) and take care to avoid damage to the seals of the relief pistons when fitting them into their bores.

16–15. Check with compressed air (approx. 7 kgf/cm^2) that the relief pistons seal properly. Drip a little oil round the relief pistons. Press a plate against the top face of the cylinder block in order to limit the movement of the relief pistons. Apply the compressed-air nozzle to the connection hole for the pressure regulator and blow.

1. The tightening torque must be 2.1 kgf m.

Fitting

a. Check that the oil line to the compressor is clean and also make sure that oil is being fed unobstructedly to the compressor.

b. Clean or change all damage, rusty or dirty air or water lines before connecting them to the compressor. Always use a new gasket for the discharge line. Also, connect the oil line.

c. Tighten the retaining screws firmly.

d. Fit the driver pin for the tachometer drive (applies only to D/DS14).

Inspection

After having fitted the compressor, check in accordance with the directions given under "Functional Check".

Draining of Coolant

If the cooling system is drained in winter it is essential to make quite sure that all water really does run out of the compressor. Normally, this takes place automatically when the engine cooling system is changed, provided that the vehicle is not tilted forwards or sideways. In such cases, the screw plug with a hexagon socket in the front left-hand part of the compressor should be undone so that the water can escape that way, thus avoiding any risk of freezing up.

Trouble Shooting

I Compressor not maintaining sufficient pressure in the system

a. Clogged air filter.

b. Excessive coking in the cylinder head or discharge line of the compressor.

c. Leaky discharge valves.

d. Excessive wear (pistons and cylinders).

e. Inlet valves leaky or stuck.

II Abnormal noise

a. Gearwheel loose on the crankshaft.

b. Excessive coking in the cylinder head or discharge line of the compressor.

c. Worn bearings.

d. Excessive wear (pistons and cylinders).

III Compressor allowing too much oil to pass

a. Excessive wear (pistons and cylinders).

b. Clogged air filter.

c. Piston rings incorrectly fitted.

d. Overpressure in the engine crankcase.

IV Compressor not being relieved

a. Defective relief-piston seals (see also "Pressure Regulator").

b. Relief mechanism has seized.

c. Tyre inflation valve set for tyre inflation. (Does not apply to vehicles with chassis numbers higher than 456001 and 372001 respectively).

COMPRESSOR 232615 (218469)

Functional Check

With the compressor running, check whether there is any abnormal noise or any sign of oil or water leakage and carry out any necessary repairs. Significant oil leakage past the piston rings is usually revealed by such indications as the accumulation of abnormal quantities of waste oil in the wet reservoir and greater coking tendencies in the cylinder head.

At regular intervals (every 10.000 km or 6.000 miles), check that the charging time for the brake system is normal. At 2.000 engine r.p.m., from 0 to 7.7 bar (kgf/cm^2) the charging time must be max. 2.5 min. for a reservoir volume of 150 litres. Check also that the compressor is relieved at the upper pressure limit of 7.7 bar (kgf/cm^2) and resumes charging at 6.7 bar (kgf/cm^2).

Reconditioning — Replacement System

Thorough inspection of the compressor is advisable as a preventive measure even if the compressor does not reveal any acute faults but has been in service for a long time. In this connection, a check should be made on the cylinder wear, on the basis of which it can be decided whether to carry out minor reconditioning or a complete overhaul. This inspection is recommended after a driving distance of about 180.000 km (108.000 miles). Attention of this kind may, however, be advisable after both shorter and longer distances, depending on the severity of the operating conditions.

In case of faults in the compressor calling for more extensive repair work, such as reboring of the cylinder, reconditioning of bearing seats, etc., we recommend replacement of the compressor by a factory-reconditioned unit.

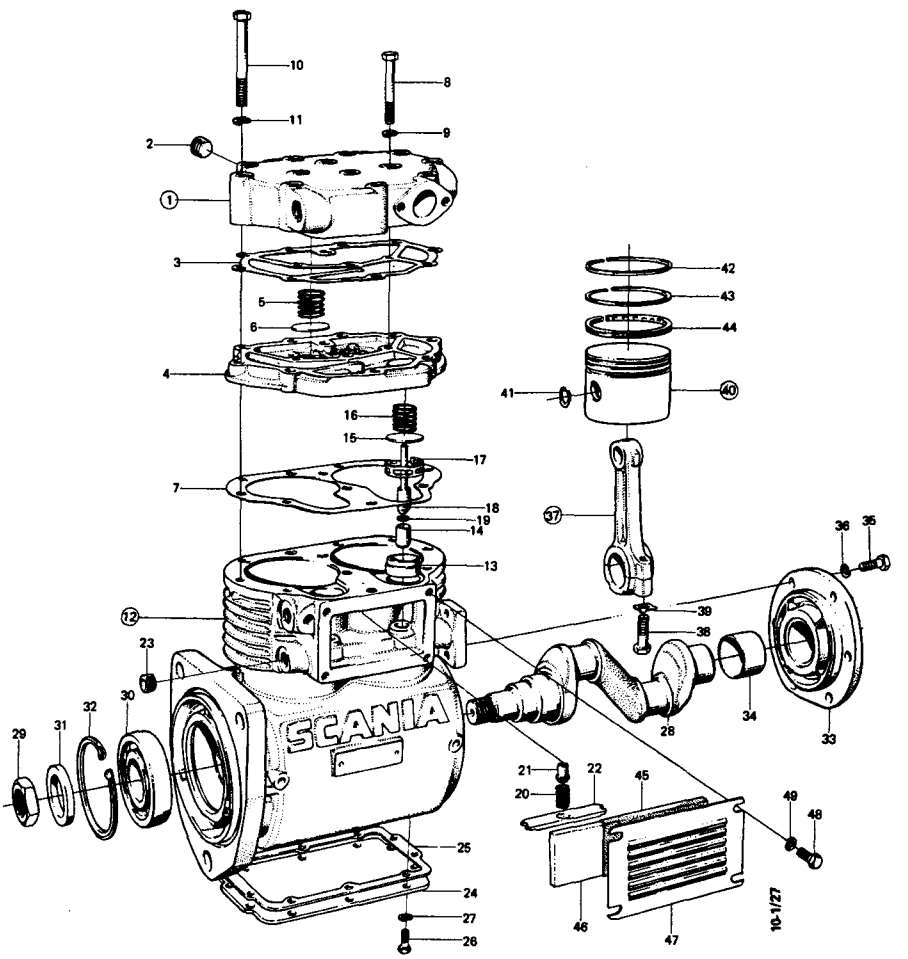


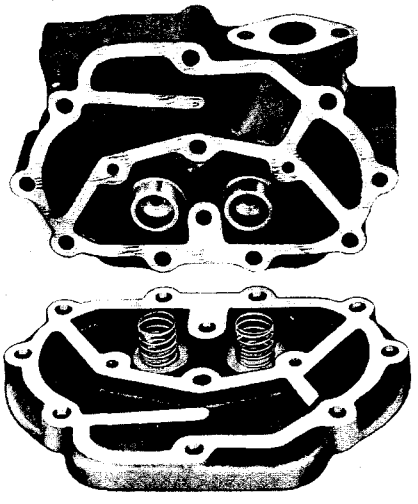
Fig. 1
Compressor 232615

Removal

1. Empty the compressed-air system by opening the drain cocks on the air receivers.
2. Empty the cooling system of the engine, which will also empty that of the compressor.
3. Remove the driver pin for the tachometer drive (applies only to D/DS14).
4. Detach the air, water and oil lines connected to the compressor.
5. Undo the compressor retaining screws and remove the compressor.
6. Detach the gearwheel of the compressor with the aid of a puller after having screwed off the stop nut. Collect the key so that it does not get lost.

Dismantling (See Fig. 1)

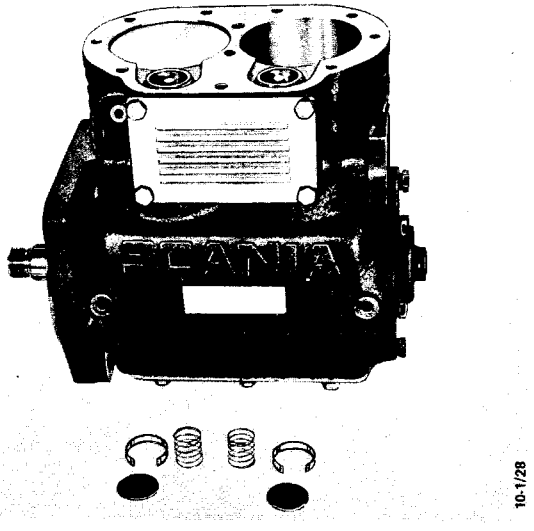
1. Clean off oil and dirt from the outside of the compressor: use a suitable cleaning agent and, if necessary, a steel wire brush.
2. Remove the cylinder head (1) and valve housing (4) in one piece by undoing the screws (10).
3. Remove the inlet valves (15), springs (16) and valve guides (17).
4. Separate the valve housing (4) from the cylinder head (1) by undoing the two remaining screws (8).
5. Remove the discharge valves (6) and valve springs (5).



10-1/29

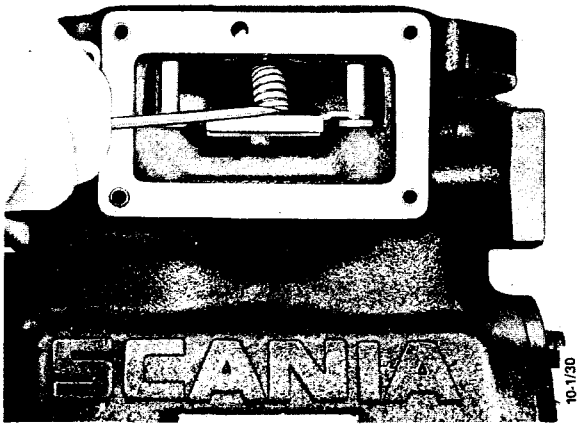
Fig. 3

6. Remove the cover (47) over the air filter.



10-1/28

Fig. 2



10-1/30

Fig. 4

7. Remove the air filter (46) and holder (45).

8. Remove the relief saddle (22) and spring (20); the spring is lifted slightly from its lower seat and taken out, whereupon the relief saddle can be lifted away.

9. Remove the relief pistons (18) by carefully admitting compressed air through the hole for the pressure governor A.

10. Remove the bottom plate (24).

11. Mark the connecting rods (37) and their caps since in reassembling they must be placed in the same positions.

12. Remove the connecting-rod caps by undoing the screws (38).

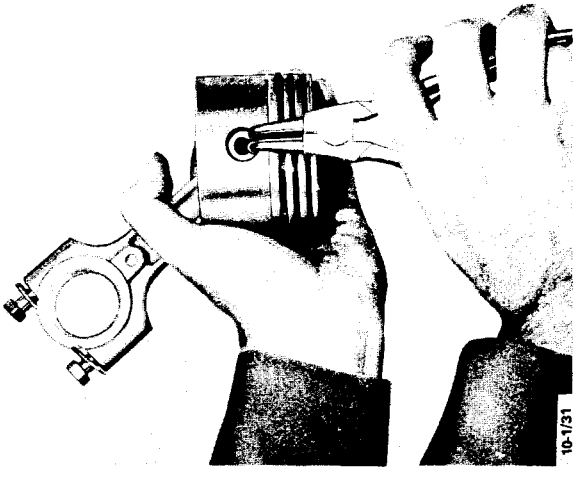


Fig. 5

15. Remove the nut (29) and the key from the crankshaft.

16. Remove the rear end cover (33).

17. Press the crankshaft (28) out towards the rear and take away the spacer (31).

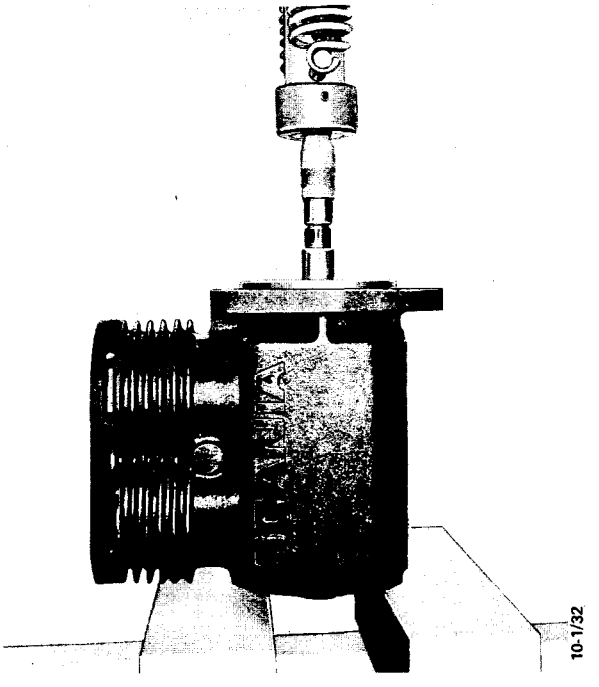


Fig. 6

13. Press the pistons (40) with connecting rods (37) out of the cylinder block and refit the caps on their respective connecting rods.

14. Remove the lock rings (41), wrist pin, connecting rod (37) and piston rings (42, 43, 44) from the pistons.

18. If the ball bearing (30) is worn so much that it has to be changed, remove the circlip (32), whereupon the bearing can be pressed out towards the front. Apply pressure on the inner race with a suitable drift, e.g. 98097 + 87115.

19. Discard all gaskets (3, 7, 25), O-rings (19), valves (6, 15) and valve springs (5, 16) and the filter insert (46).

75.16710/3200 – 10.332

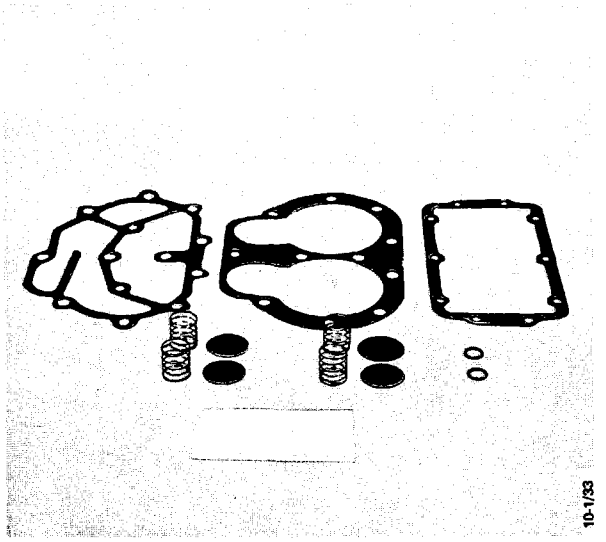


Fig. 7

Parts rejected

Inspection and Replacement of Parts

Clean all components prior to inspection.

Sealing Surfaces

Check that all sealing surfaces (between cylinder head and valve housing, valve housing and cylinder block, etc.) are plane so that effective sealing is obtained.

Cylinder head (1), valve housing (4) and cylinder block (12)

Inspect the cylinder head, valve housing and cylinder block for cracks or other damage. If any damage is found, change the affected parts.

Water Passages

Check the water jackets of the cylinder head and valve housing for leaks. If leakage is suspected, assemble them temporarily and test the cooling system for leaks under pressure.

Inlet and discharge valves, springs and seats

Change all the valves and valve springs. If the seats (13) of the inlet valves are worn they must be changed. The valve seats can be removed with an expander puller. A suitable tube can be used as a spacer (Fig. 8). Press the new valve seat in with the aid of a suitable drift, e.g. No. 88091 (Fig. 9). If the seats of the discharge valves are worn the valve housing (4) must be changed.

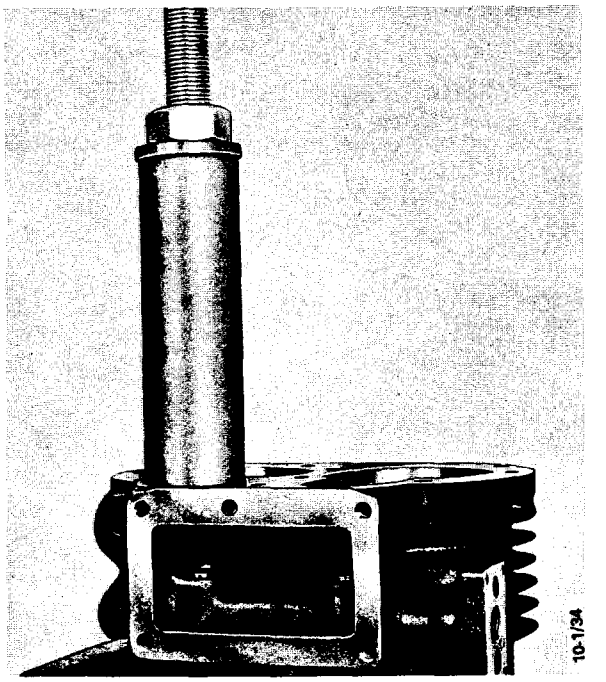


Fig. 8

Removal of seat for intake valves

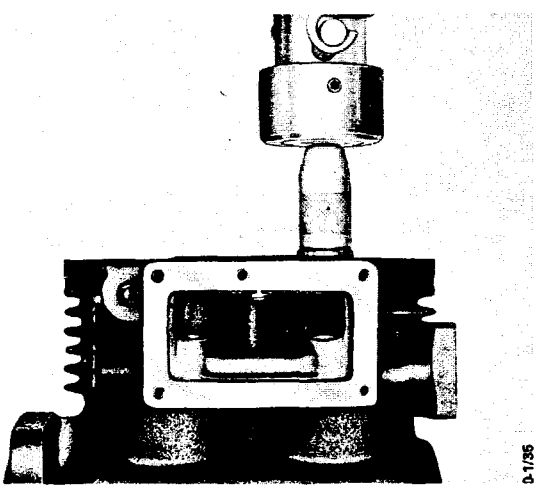


Fig. 9

Assembly of seat for intake valves

Relief Mechanism

Check the relief pistons (18) and their bushings (14) in the cylinder block for wear. The bores must not be scored or damaged in any way that could cause leakage and accelerate wear on the O-rings. If such damage is found, or where there is considerable wear, the bushing should be changed. To do this, first tap the bushing with an M14 thread-cutting tap and then pull it off with the aid of a screw and a sleeve.

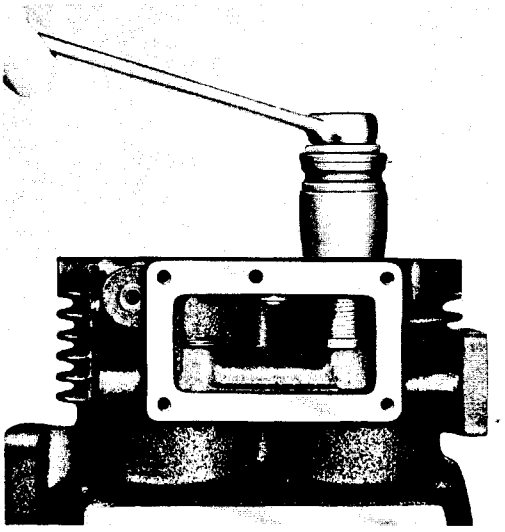


Fig. 10

Fit new O-rings on the relief pistons and lubricate them thoroughly with a heatresistant special grease (order No. 246746). Check that the return spring of the relief mechanism has sufficient tension to return the relief pistons to their rest position.

Cylinder Bores

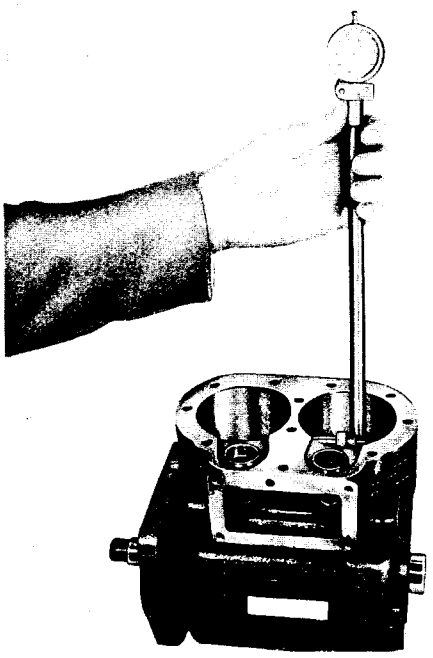


Fig. 11

Measuring cylinder

Check the cylinder bores for wear, ovality or other damage (see Fig. 11). Cylinder bores that are scored or out of round by more than 0.05 mm (0.002") or tapered more than 0.08 mm (0.003") should be rebored or ground to oversize. Oversize pistons are available for 0.010" and 0.020". The clearance between the piston and the cylinder bore should be 0.08–0.11 mm (0.003–0.004")

Pistons and Wrist Pins

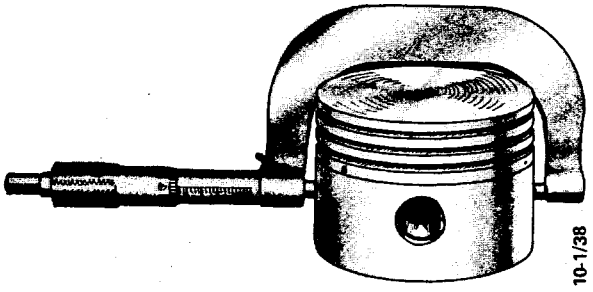


Fig. 12

Measuring piston

Examine the pistons for wear, scorings or other damage and change them if necessary. Check the piston wear with the aid of a micrometer (Fig. 12); as stated above the piston clearance must be 0.08–0.11 mm (0.003–0.004") in relating to the existing cylinder diameter.

The wrist pins must have a light press fit in the pistons.

Piston Rings

Check the fit of the piston rings in the ring grooves. The clearance between piston ring and ring groove must be 0.01–0.06 mm (0.0004–0.0023").

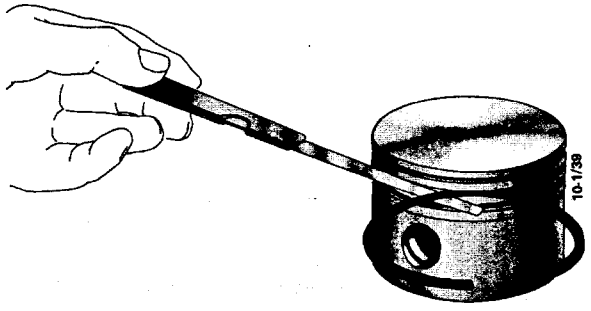


Fig. 13

Measuring ring fit

Check the ring gap with the rings fitted in the cylinder bore. Press the piston rings down about 15 mm (0.6") in the cylinder bore with the aid of a piston. The ring gap for the upper compression ring and for the oil scraper ring should be 0.13–0.25 mm (0.005–0.010"). For the other compression ring, the gap should be 0.08–0.17 mm (0.003–0.007").

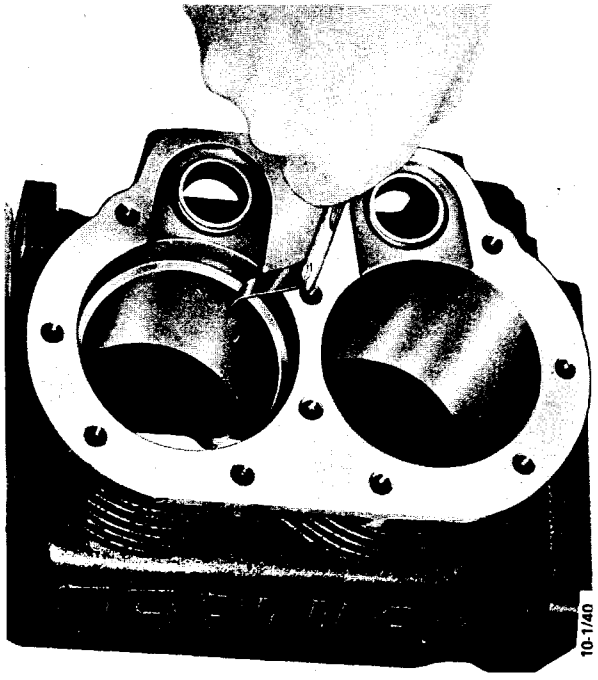


Fig. 14

Measuring ring gap

Connecting Rods, Crankshaft and Main Bearings

Check the bearing surfaces of the connecting rods for wear. If the bearing shells are damaged or worn the connecting rods must be changed. The clearance between connecting rod and crankpin must not exceed 0.04 mm (0.0015"). Check the crankshaft for damage and wear. If damage or wear is found, the crankshaft must be changed. The clearance between the crankshaft and the sliding bearing (34) of the rear end cover must not exceed 0.09 mm (0.0035"). If the sliding bearing (34) is damaged, a new end cover complete with bearing must be fitted.

Assembly

1. Lubricate all bearing and sliding surfaces with clean engine oil.
2. If the ball bearing has been removed, press it on from the front, using tool 87443, and lock it with the circlip.
3. Press the crankshaft in from the rear, using tool 87089.

4. Before fitting the rear end cover (33), its sealing surfaces against the crankcase must be coated with a suitable oil-resistant sealing compound (Permatex or an equivalent). The screws (35) must be tightened with a torque of 10–12 Nm (1.0–1.2 kgf m).

5. Mount the spacer (31) and the nut (29) on the crankshaft. Check that the crankshaft rotates freely in the crankcase.

6. Lubricate the wrist pins with clean engine oil and mount them and the connecting rods in the pistons. Lock the wrist pins with the lock rings (41).

7. Fit the piston rings, making sure that the "top" marking faces upwards. This is important in view of the shape of the rings. Check also that the second ring has a chamfer which must face downwards. Locate the rings so that their gaps do not come one below the other but are distributed round the piston.

8. Oil the cylinder bores and pistons. Fit the pistons and connecting rods in the cylinder block. Firest, detach the cap on the connecting rod which is to be inserted and turn the crankshaft so that the crankpin concerned faces downwards. Make sure that the connecting rod and cap are fitted on the same crankpin as before. Tighten the connecting-rod screws (38) with a torque of 14–17 Nm (1.4–1.7 kgf m) and lock the screws with the lock washers (39). Make sure that the pistons can move freely in the bores.

9. Fit the bottom plate, using a new gasket, and tighten the screws with a torque of 6–8 Nm (0.6–0.8 kgf m).

10. Fit new O-rings (19) on the relief pistons and lubricate them with heatresistant special grease (order No. 246746). Place the relief pistons in their bushings and fit the relief saddle (22) and the spring (20). Check the function of the relief mechanism by admitting compressed air through the connection for the pressure regulator.

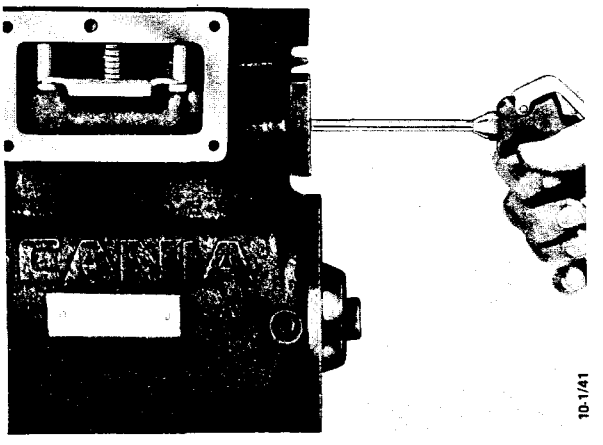


Fig. 15

Checking relief mechanism

11. Fit new discharge valves (6) and springs (5) and assemble the valve plate (4) with the cylinder head (1). Tighten the screws (8) with a torque of 6–8 Nm (0.6–0.8 kgf m). Check that the valves can move freely.

12. Fit new inlet valves (15), springs (16) and valve guides (17). The open part of the valve guide must face towards the cylinder bore. Mount the cylinder head and valve plate assembly on the cylinder block and tighten the screws (10) with a torque of 21–24 Nm (2.1–2.4 kgf m). Check that the inlet valves can move freely.

13. Fit a new air filter (46) in the holder (45) and place the latter in its recess on the compressor. Mount the cover (47) and tighten the screws with a torque of 6–8 Nm (0.6–0.8 kgf m).

14. If the compressor is not going to be installed on a vehicle straight away all its connections should be sealed to prevent dirt from making its way into the compressor.

AR

75.16710/3200 – 10.333