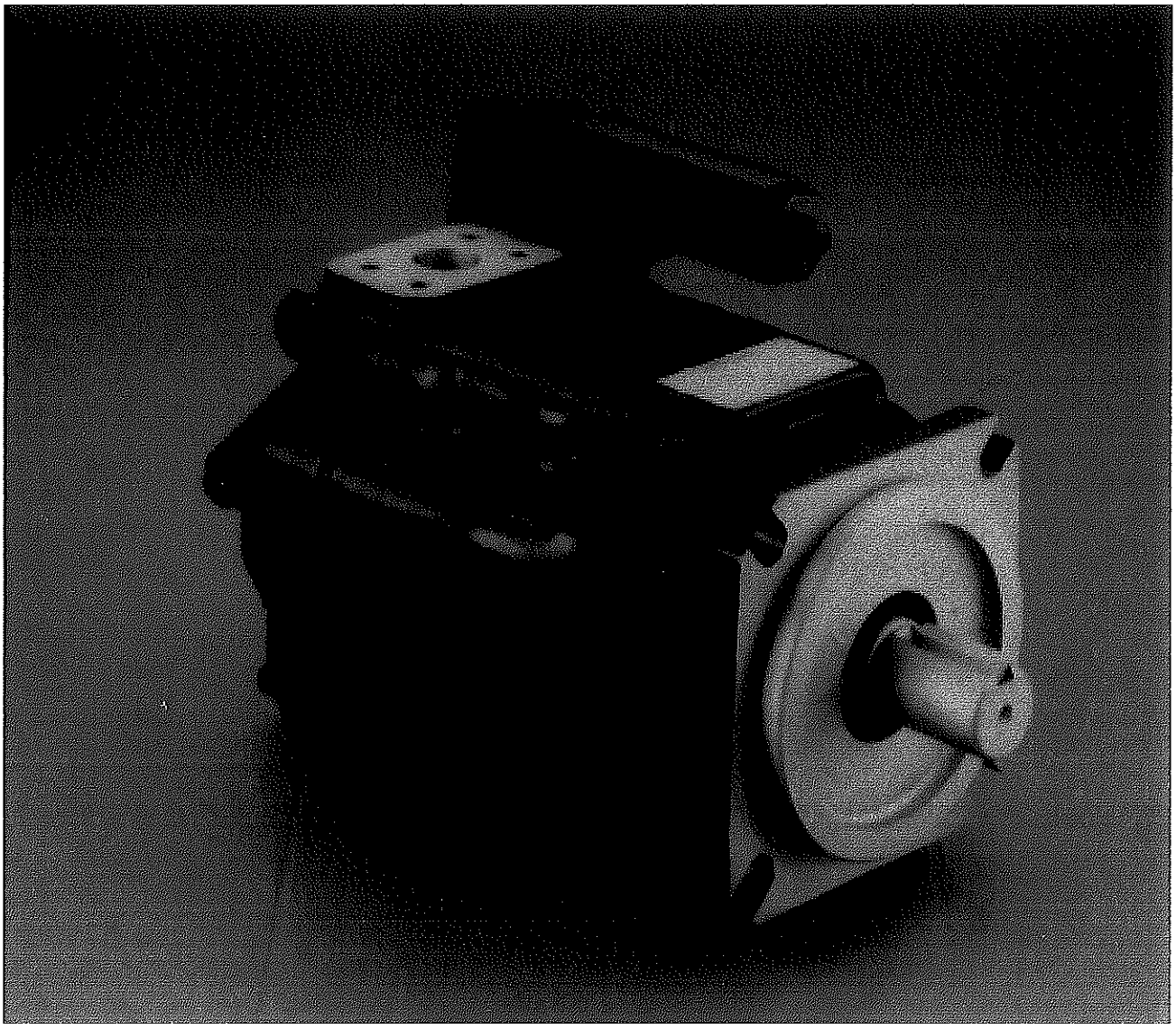
Vickers®

Overhaul Manual

Piston Pumps

PVH Piston Pumps

Including Controls



VICKERS

Rev. 2/93

M–2210–S

Section 1 – Introduction

A. Purpose of Manual

This manual describes basic operating characteristics and provides overhaul information for the Vickers PVH 57/74/98/131 series piston pumps. The information contained herein pertains to the latest design series as shown in the model code.

B. Related Publications

Installation dimensions for the PVH series pumps and controls are not included in this manual. Individual parts numbers for the basic pumps are also not included. Refer to the related publication list below for publications that include this type of information.

PVH57	Service drawing	M–2206–S
PVH74	Service drawing	M–2207–S
PVH98	Service drawing	M–2208–S
PVH131	Service drawing	M–2209–S
PVH	Series Application	GB–C–2010

C. Model Code Description

Variations within each basic model series are covered in the model code as shown on the next page. Service inquires should always include the complete unit model code number as stamped on the name plate, and the assembly number as stamped on the mounting flange.

Model Code

Industrial pumps

PVH *** QI * – * (*) * – ** * – 10 – C(M) ** (**) (**) – *0 – ***

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Mobile pumps

PVH *** – C – * (*) * – ** * – 10 – C ** (**) (**) – *0 – ***

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 Piston pump, variable displacement

2 Maximum geometric displacement

57 = 57.4 cm^3/r (3.5 in^3/r)
74 = 73.7 cm^3/r (4.5 in^3/r)
98 = 98.3 cm^3/r (6.0 in^3/r)
131 = 131.1 cm^3/r (8.0 in^3/r)

3 Industrial version

4 Mounting flange, prime mover end

C = SAE "C" 4–bolt type (SAE J744-127-4)
M = ISO 3019/2–125B4HW (Option for PVH57QI and PVH/74QI only)

5 Shaft rotation, viewed at prime mover end

R = Right hand, clockwise (Standard on QI models)
L = Left hand, counterclockwise (Optional on QI models)

6 Configuration

Blank = Non-thru-drive (single pump)
A = Thru-drive pump with SAE "A" 2-bolt rear flange mounting (SAE J744-82-2)
B = Thru- drive pump with SAE "B" 2- and 4-bolt rear flange mountings♦ (SAE J744-101-2/4)
C = Thru-drive pump with SAE "C" 2- and 4-bolt rear flange mountings♦ (SAE J744-127-2/4)
S = Adjustable maximum volume stop (non-thru-drive and non-torque-control pumps only)

7 Main ports

F = SAE 4-bolt flange pads (standard)
M = SAE 4-bolt pads with metric mounting bolt threads (PVH57 & PVH74 only)

8 Shaft-end type, at prime mover end

N =	ISO 3014/2-E32N	Short straight keyed
1 =	SAE "C" (J744-32-1)	Straight keyed
2 =	SAE "C"▪ (J744-32-4)	Splined 14 tooth 12/24 D.P.
3 =	SAE "CC" (J744-38-4)	Splined 17 tooth 12/24 D.P.
12 =	SAE "D" (J744-44-4)	Splined 13 tooth 8/16 D.P.
13 =	SAE "C (J744-38-1)	Straight keyed
16 =	SAE "D" (J744-44-1)	Straight keyed

9 Shaft seal, prime mover end

S = Single, one-way (standard)
D = Double, two-way (optional) Recommended on second pump of tandem assembly (PVH**/ PVH**)

10 Pump design number

10 (Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.)

11 Pressure compensator adjustment range

C = 70-250 bar (1015-3625 psi) (standard)
CM = 40-130 bar ((580-1885 psi) (optional QI version)
IC = Industrial control
UV = Unloading valve control for accumulator circuits

♦ Built from pump with SAE "A" rear pad to which suitable flange adapter is bolted. For best availability and flexibility, order PVH SAE "A" thru-drive pump and SAE "B" or "C" adapter kit separately.

12 Pressure compensator factory setting in tens of bar

25 = Normal factory setting of 250 bar for "C" models.
7 = Normal factory setting of 70 bar for "CM" models.

13 Additional control functions

Blank = No additional controls
V = Load sensing, 20 bar differential pressure setting
T = Torque limiter
VT = Load sensing and torque limiter

14 Torque limiter factory setting

** = Customer desired torque limiter setting specified in ten bar (145 psi) increments, e.g.:
8 = 80 bar (1160 psi);
18 = 180 bar (2610 psi).
The torque setting range is from 30–80% of the specified compensator setting.

15 Control design number

31 = C, CM, or C**V controls.
13 = C**T controls
14 = C**VT controls
10 = UV and IC controls

16 Special features suffix

027= Composite 2-bolt/4-bolt mounting conforming to SAE "C" (except PVH131)
031= Thru-drive SAE "A" pad cover
041= No case-to-inlet relief (for use with supercharged circuits)
057= Shaft-up operation (vertical mount)

▪ Torque restrictions apply to #2 shaft in PVH74 and 98 thru-drive, and PVH131 single and thru-drive, pumps. Vickers is not responsible for misapplied usage of these shafts. Please contact a Vickers representative for review of your application.

Section 2 – Description

A. Basic Pump

Figure 1 shows the basic construction of the PVH series piston pump. Major parts include the drive shaft, housing, yoke, rotating group, valve plate, control piston, bias piston, valve block and compensator control. The PVH series replaces the pintle bearing assembly with saddle bearings, which reduces weight and eliminates the roller bearings that added to maintenance time and overhaul costs.

B. Pump Controls

Two common pump control types are available. One type is the standard "C" compensator control that limits pump outlet pressure to a desired level. The other type is the "CV" pressure limiter/load sensing control. Now available is the "IC" (Industrial Control) which can be used as a load sensing compensator, remote compensator control and electrohydraulic control. These limit pump outlet pressure and also regulate pump displacement to match load requirements.

Section 3 – Principles of Operation

A. Pump Operation

Rotation of the pump drive shaft causes the cylinder block, shoe plate and pistons to rotate (See Figure 2). The piston shoes are held against the yoke face by the shoe plate. The angle of the yoke face creates a reciprocating motion to each piston within the cylinder block. Inlet and outlet ports connect to a kidney slotted wafer plate. As the pistons move out of the cylinder block, a vacuum is created and fluid is forced into the void by atmospheric pressure. The fluid moves with the cylinder block past the intake kidney slot. The motion of the piston reverses and fluid is pushed out of the cylinder block into the outlet port.

Warning

Before breaking a circuit connection, make certain that power is off and system pressure has been released. Lower all vertical cylinders, discharge accumulators, and block any load whose movement could generate pressure. Plug all removed units and cap all lines to prevent the entry of dirt into the system.

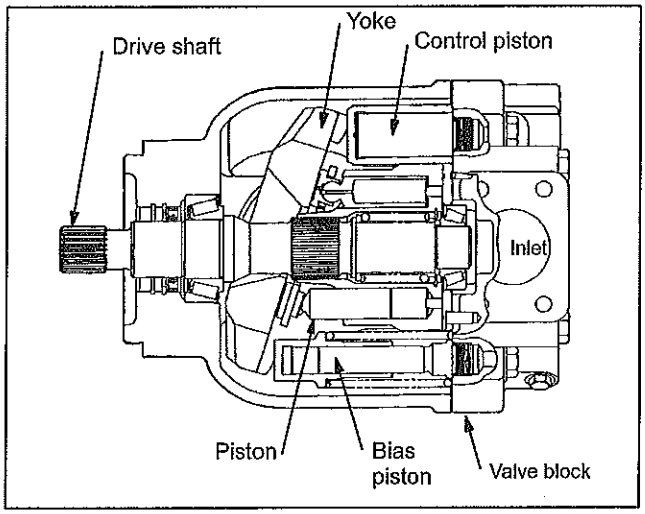


Figure 1. PVH Section View

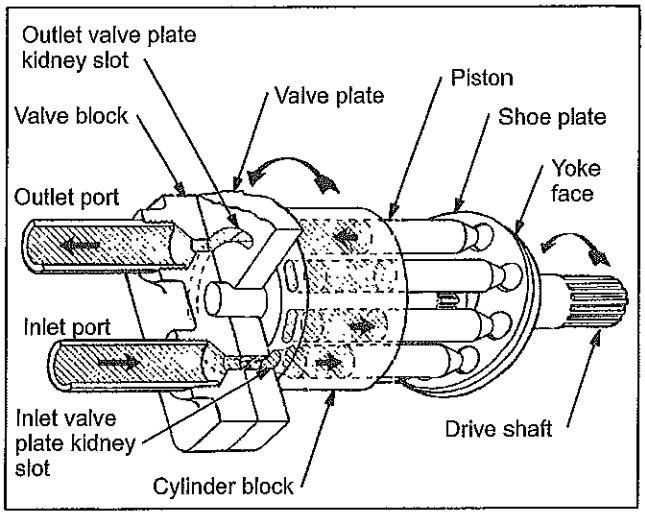


Figure 2. PVH Pump Operation

B. Pump Controls

Pressure Compensator Controls "C" & "CM"
(Figure 3)

The standard "C" and low pressure "CM" compensator controls are internally pilot operated, spring offset, 2-way valves. Their purpose is to limit system pressure to a desired level by varying pump displacement. These controls only provide the flow required to satisfy the load demand, while maintaining a constant preset pressure.

During operation, load or system pressure is continually fed to the bias piston. The function of the bias piston is to maintain the yoke at a full pump displacement position. Load or system pressure is also fed to the compensator spool chamber within the control. Pressure within the compensator spool chamber acts upon the spring force of the compensator spring.

When load or system pressure is below the pressure setting of the compensator spring, the compensator spool remains offset and the pump continues to operate at full displacement. When load or system pressure approaches the compensator pressure setting, the compensator spool will start to move and overcome the compensator spring force. Fluid will then meter into the control piston area. Since the control piston area is greater than that of the bias piston, the control piston pushes the yoke towards minimum pump displacement. The compensator control continues to meter fluid to the control piston, adjusting the pump displacement, and pumping only enough fluid to satisfy the load demand while holding the system at a constant pressure.

When load or system pressure exceeds the compensator setting, the compensator spool shifts towards the spring chamber area. A maximum amount of fluid is then metered to the control piston area, causing the yoke to shift to minimum pump displacement.

When system pressure decreases below the compensator pressure setting, the compensator spool returns to its original position and the yoke returns to maintain maximum pump displacement.

The compensator is available in two pressure ranges. The "C" spring has an adjustment range of 70–250 bar (1015–3625 psi). The "CM" spring has an adjustment range of 40–130 bar (580–1885 psi).

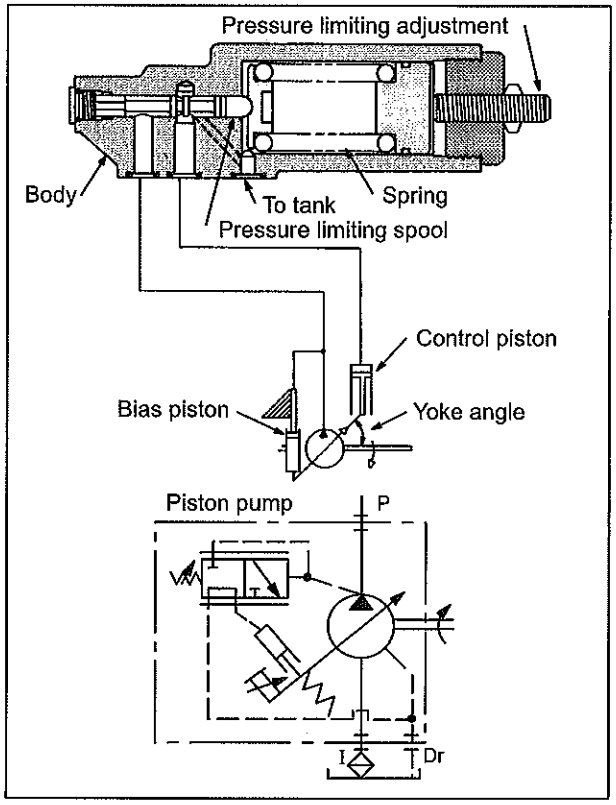


Figure 3. "C" & "CM" Controls

Load Sensing & Pressure Compensator Control C(M)*V
(Figure 4)

This pump will provide power matching of pump output to system load demand, maximizing efficiency and improving load metering characteristics of any directional control valve installed between the pump and the load.

Load sensing ensures that the pump always provides only the amount of flow needed by the load. At the same time, the pump operating pressure adjusts to the actual load pressure plus a pressure differential required for the control action. Typically, the differential pressure is that between the pressure inlet and service port of a proportionally controlled directional valve, or a load sensing directional control valve.

When the system is not demanding power, the load sense control can operate in an energy-saving stand-by mode. To achieve the low pressure, no flow, stand-by mode, the load sense signal line must be drained to the tank externally.

The standard differential pressure setting for load sense is 20 bar (290 psi), but can be adjusted to between 17 and 30 bar (247 and 435 psi) on the pump.

If the load pressure exceeds the system pressure setting, the pressure compensator de-strokes the pump. The load sensing line must be as short as possible and can also be used for remote control or unloading of the pump pressure. For remote control, it is recommended that you contact your Vickers representative for the correct configuration of the control.

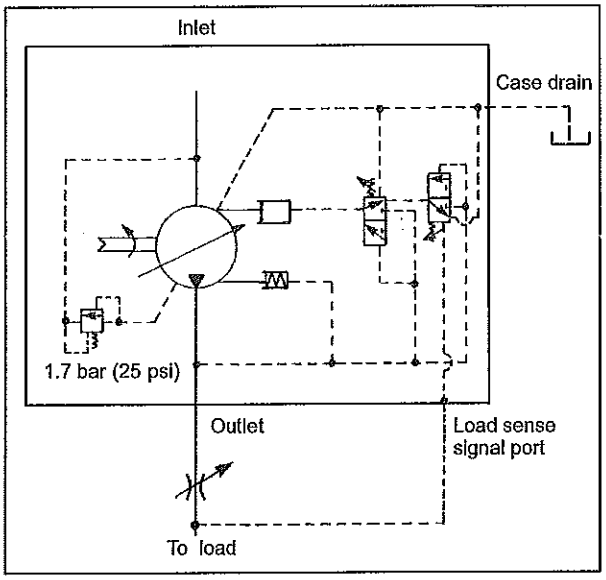


Figure 4: C(M)*V Control

PVH with UV Control for Accumulator Circuits
(Figure 5)

This pump control functions as a load- sensing pressure compensator that unloads the pump at a preset pressure and loads the pump after preset pressure drop.

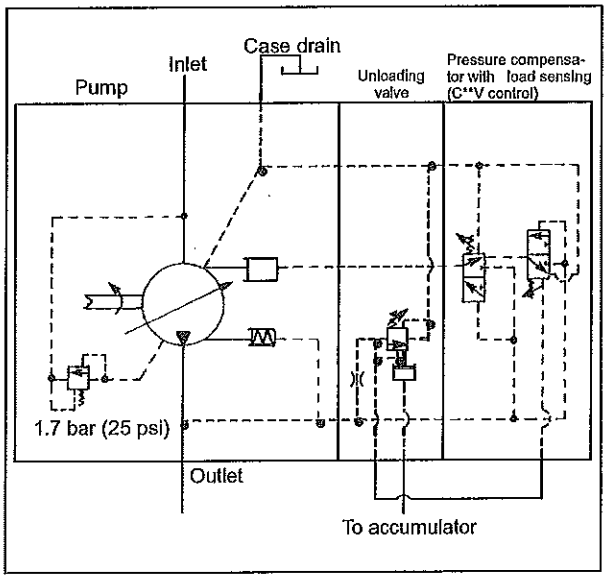


Figure 5: UV Control

Pressure & Torque Limiter Control CT**
(Figure 6)

This pump senses pressure and flow and starts destroking at a predetermined input torque level. The rate of flow reduction is normally tailored to follow the maximum power capability curve of the prime mover. Input torque is limited while the pressure compensator limits the system pressure.

When the input speed remains constant (i.e. industrial drives), the torque limiter acts as an input power limiter. This allows a smaller electric motor to be used if maximum pressure and maximum flow are not required at the same time. At low load levels, the control permits high pump displacement and high load speeds. Under heavy loads, speed is reduced, preventing stalling of the prime mover. In the case of variable speed drives (I.C. engines), this function provides, in addition to pressure compensation or limiting, a torque limiting ability that can be adjusted to the torque/speed characteristics of the engine.

The start of torque limiting (pump-destroking) is pressure dependent. The pressure is selectable (see model code) and is factory preset to between 30% and 80% of the maximum pressure control setting. The adjustment range for the "C" compensator is 80 to 200 bar (1160 to 2900 psi) in 10 bar (145 psi) increments. There is no "CM" spring option available with the torque limiting control.

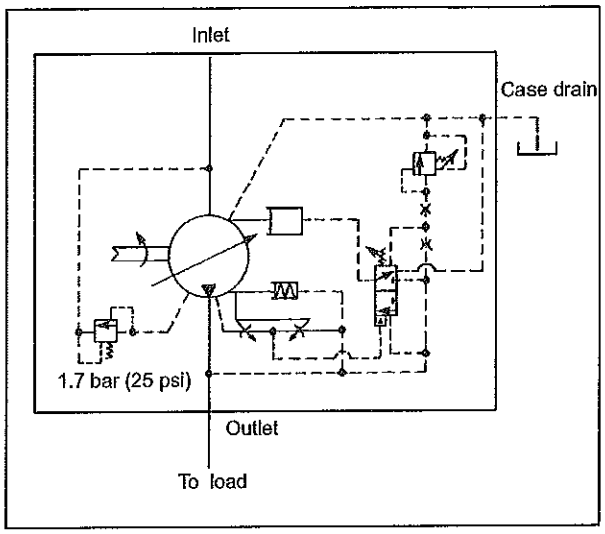


Figure 6: CT Control**

Torque Limiting Plus Load Sensing Control CVT**
(Figure 7)

This pump control option functions like a load sensing control, but with additional torque limiting tailored to the size of the drive motor selected. The limiting function is the same as for a pressure compensator with torque limiting. The combination of the two controls provides the following benefits:

1. The energy savings of a variable displacement load sensing control.
2. The pump pressure follows the load pressure.
3. The torque control allows smaller drive motors to be used.
4. The pressure compensator de-strokes the pump as maximum pressure is reached.
5. The pump pressure can also be remotely controlled using the load sense line. The C**VT control allows complete control of flow and pressure, either mechanically or electrically, if used with proportional valves.

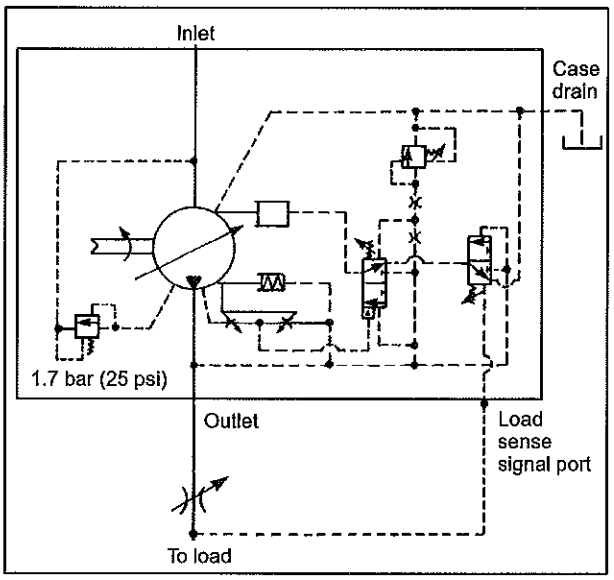


Figure 7: CVT Control**

Industrial Control
(Figures 8 & 9)

This pump control option is intended for use when multiple, remote, or electrically controlled compensating settings, with or without load sensing, are desired.

Pressure compensation is obtained by removing an internal plug, keeping the load-sense signal port plugged, and internally applying pilot pressure to the spring chamber of the pilot-operated control spool. For pressure compensation with load sensing, the internal plug stays, the load-sense signal port is unplugged, and pilot pressure is externally applied.

An external relief valve is used to set system pressure. The externally adjustable control-spool spring determines the differential pressure setting of the pump control. Pilot (spring chamber) pressure is separated from outlet pressure by an internal orifice. Outlet pressure shifts the spool when pressure drop across the orifice reaches the differential pressure setting, and the pump de-strokes.

The relief valve can be mounted to an NFPA-D03/ISO 4401-03 pad on the pump control, or remotely located via tapping and blanking plates installed on the pad.

The standard factory-set differential pressure setting of the pump control is 20 bar (290 psi) and is not specified in the pump model code. Any other ordered differential pressure, within the control's adjustable pressure range of 17–35 bar (247–508 psi), will be specified in the model code following the "IC" control code; for example, "-IC30-" for a 30 bar setting.

Application examples:

Mounting	Control Type
• EHST	Electrical control compensator
• DG valve w/DGMC	Double or triple compensator
• C–175	Remote control relief valve
• CGE–02	Electrical relief valve

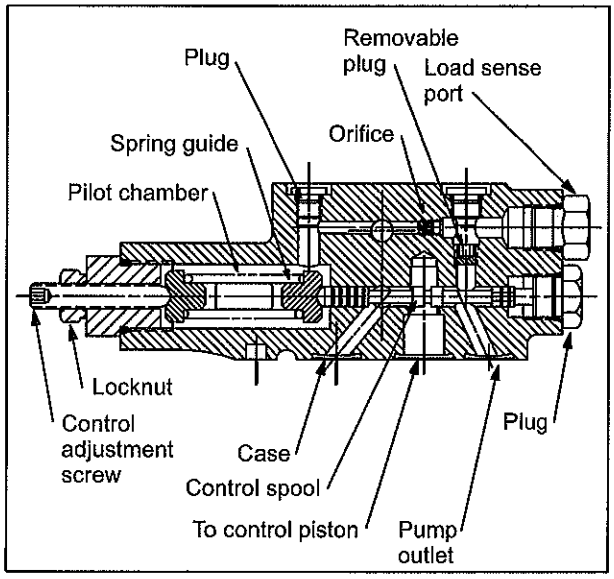


Figure 8: Industrial Control Section View

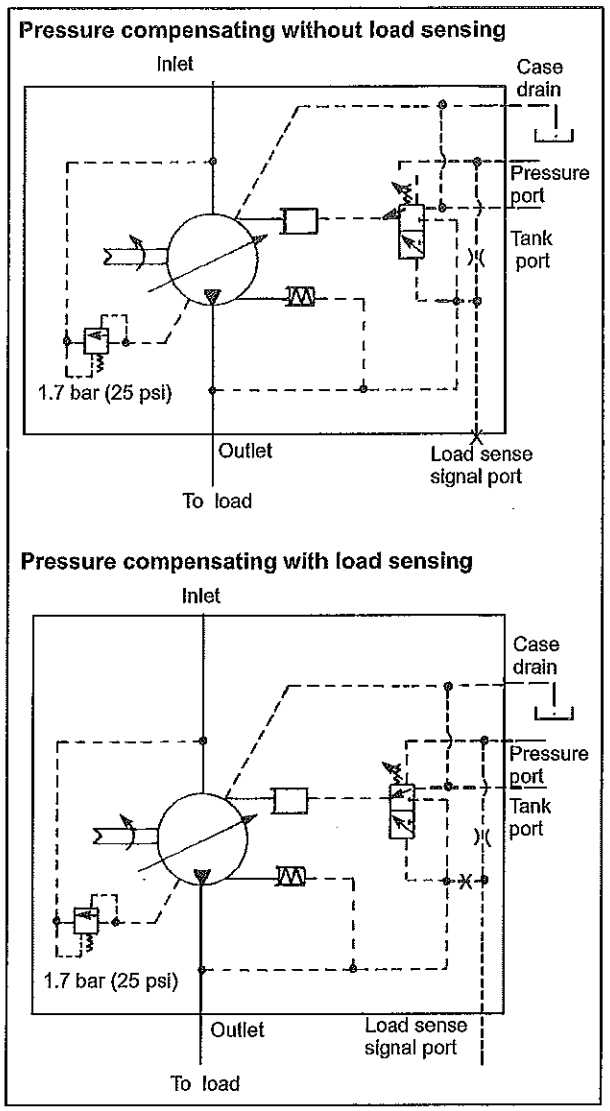


Figure 9: Industrial Control

C. Load Sensing/Pressure Limiting Operation

As one would expect from the title, this control is a combination of the features of both the pressure limiting and load sensing controls. Refer to Figure 10.

The load sensing spool senses the pressure difference (pressure drop ΔP) between pump outlet and load pressure across a series flow control or system directional valve which is inherent in its operation. This differential pressure causes the load sensing spool to move against its spring to the closed–center position. If the differential pressure (pressure drop ΔP) increases (greater flow through the series valve), the load sensing spool moves to the right. This opens discharge to the control piston. Outlet pressure at the control piston strokes the yoke toward a lower flow and when differential pressure again causes the load sensing spool to move to the closed-center position.

If differential pressure lowers (less flow through the series valve), the load sensing spool moves to the left, opening the control piston to tank. The bias piston then strokes the yoke toward a higher flow. When differential pressure (pressure drop), increases enough to move the load sensing spool to the closed-center position, yoke movement will stop and flow will remain constant.

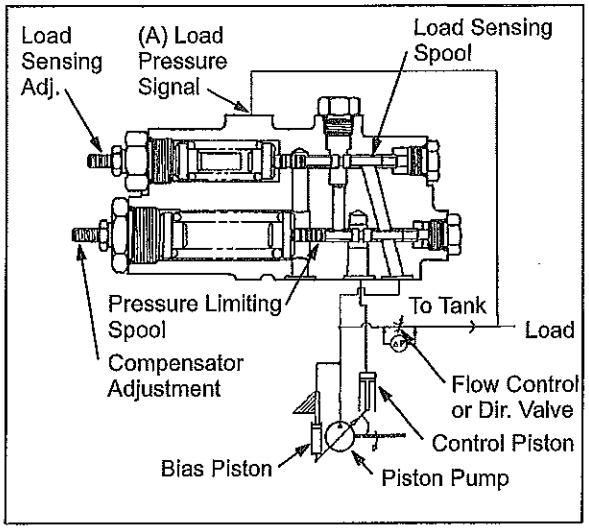


Figure 10: Load Sensing Control System

The load sensing portion of the control operates as a function of the pressure drop across the series valves (pressure drop ΔP), and is independent of system pressure. It establishes a constant flow characteristic from the pump based on the magnitude of the directional valve opening (operator controlled).

If outlet pressure increases to the maximum pressure limit setting, the pressure limiting spool meters fluid to the control piston. The control piston moves the yoke to reduce flow. If outlet pressure continues to rise, the spool will continue to meter fluid to the control piston and the pump will stroke to zero flow at maximum pressure.

Reduced horsepower standby feature

When the system flow control valve or directional valve is closed completely, the circuit is placed in standby.

Note

This feature assumes the system flow control valve or directional valve provides decompression of load sensing pressure in the standby, fully closed position. Pressure at point A (Figures 10 & 11) must decay toward zero through the system flow control or directional valve for standby to occur. Decompression of the load sensing pressure allows the pump to stroke to zero flow and minimum pressure. The circuit functions in the following manner.

Assume the flow control or directional valve is closed and there is no bleed of point A (Figure 10) to tank. The fluid is trapped and the load sensing spool is held to the left by the spring. The system pressure rises until the pressure limiting spool takes over. The yoke then stokes to zero flow and holds pressure at the maximum limiter setting.

If, in the closed condition, the flow control or system directional valve bleeds point A (Figures 10 & 11) to tank, the load sensing feedback pressure will decay. The load sensing spool will shift to the left. Fluid then meters through the pressure limiting spool and into the control piston. Outlet pressure decays through pump leakage following the decay of feedback pressure A (Figures 10 & 11) until minimum pressure drop is reached. The pump will operate in the standby mode (zero flow, minimum pressure) until the flow control or system directional valve demands flow from the pump. At this time, normal operation of the control will resume.

D. Adjustment procedure: Load Sensing Pressure Limiting Control

General

This procedure contains information on the PVH pressure limiting and load sensing control. Test and adjustment procedures are provided for standard units.

Note

Pressure gauges must be installed into the system before adjustment of the control can be performed. Complete field test adjustment procedures are included.

Set up

Make sure all machine controls are in the OFF or neutral position.

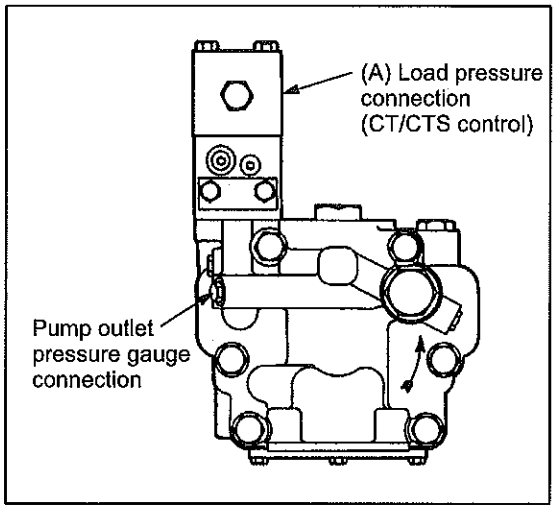


Figure 11: Gauge Connection

Connect a 5000 psi pressure gauge at the outlet of the piston pump and on load sensing models, in the load sensing line.

Check pump housing to verify that it is full of system fluid.

Jog the engine to prime the pump, then exercise the controls to eliminate entrained air in the system.

Pressure Limiter Adjustment

Move an appropriate cylinder on the machine until it bottoms out. From the center condition, crack the control valve lever toward the bottomed out position enough to allow pressure build up in the system. DO NOT exceed the maximum pressure limit noted in Table 1. If the maximum pressure limit does not correspond to Table 1, adjustment of the control is required.

Caution

DO NOT adjust control while machine is running.

Adjust the pressure limit set screw (clockwise to increase, counterclockwise to decrease) until the pressure noted in Table 3 is obtained.

Pump Model	Maximum Pressure Limit	
	bar	psi
–C18V–30	180	2610
–C19V–30	190	2755
–C20V–30	200	2900
–C25V–30	250	3625

Table 1. Control Pressure Specifications

Load Sensing Valve Adjustment
While slowly moving an actuator on the machine, observe pump pressure and load pressure. The difference between pump pressure and load pressure is the load sense pressure drop. To increase the load sensing pressure drop (ΔP), rotate load sensing adjusting screw clockwise. To decrease the setting, rotate the load sensing adjusting screw counterclockwise. The standard factory setting is 290 psi Δ. If this pressure drop is set too low, system instability can occur. Correct this by increasing pressure drop.

E. Overhaul of PVH Controls

Disassembly of C, CM Control (Refer to Figure 12)

Caution

DO NOT disassemble or remove control while engine is running. Make sure power is OFF and hydraulic cylinders are lowered. Discharge accumulators and block any load whose movement could generate pressure.

Note

In the following step if pump control is mounted at the 12 o'clock position, complete draining of the pump will not be required. Some draining will occur until fluid level reaches drain port level of the control.

1. Remove drain plug (47, see Figure 29) from pump housing and drain fluid from pump. Remove all tubing connected to the control.

2. Remove the control by loosening four screws (1b) that hold the control to the valve block. Remove o–rings and discard.

3. Install the control into a vise with the jaws resting on the outside of body (13b).

4. Remove nut (4b), with the associated o–ring (7b). Remove adjusting screw (5b), remove spring seat (6b), spring (8b) and spring guide (9b).

5. Remove plug (10b) and o–ring (11b), remove spool (12b).

Follow the same inspection, repair and replacement procedure as outlined for the Industrial Control.

Assembly

Note

Obtain seal kit for the control (check service drawing for part number). Replace all seals and back up rings with new ones from the kit. Refer to Figure 12 during assembly. Special assembly procedures will be noted in the step–by–step procedure.

Note

Lubricate all parts with system fluid at assembly. O–rings and back up rings require a viscosity improver to facilitate assembly.

1. Assemble spool (12b) into valve body (13b) with rounded end of spool pointing toward adjustment plug end of valve. Assemble o–ring (11b) on plug (10b) thread plug (10b) into body (13b). Torque plug to 9.8–10.2 N.m. (7–7.5 lb.ft.).

2. Install parts (9b, 8b, 6b, 5b) in the order shown in exploded view.

3. Install plug (4b) and o–ring over spring seat (6b). Make sure adjusting screw (5b) is threaded through plug (4b). Make sure adjusting screw (5b) is lubricated. Thread on nut (3b).

C Control (b)

Item	Description	Qty	Item	Description	Qty
1b	Screw	4	7b	O–Ring	1
2b	O–Ring	3	8b	Spring	1
3b	Nut	1	9b	Spring guide	1
4b	Plug	1	10b	Plug	1
5b	Adjusting screw	1	11b	O–Ring	1
6b	Spring seat	1	12b	Pressure comp. spool	1
			13b	Control body	1

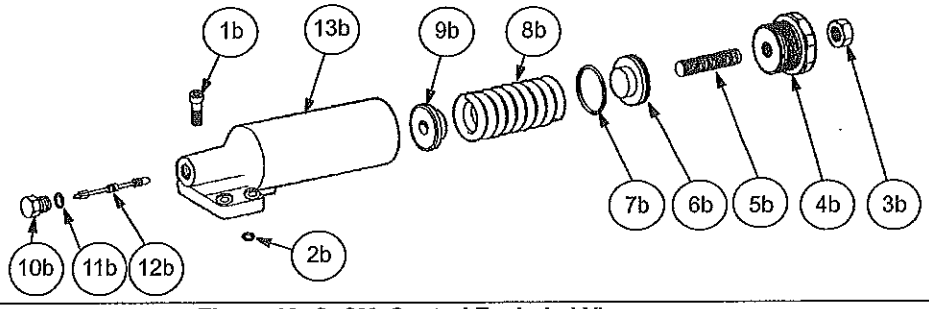


Figure 12: C, CM Control Exploded View

Disassembly of CV Control (Refer to Figure 13)

Caution

DO NOT disassemble or remove control while engine is running. Make sure power is OFF and hydraulic cylinders are lowered. Discharge accumulators and block any load whose movement could generate pressure.

Note

In the following step if pump control is mounted at the 12 o'clock position, complete draining of the pump will not be required. Some draining will occur until fluid level reaches drain port level of the control.

1. Remove drain plug (47, see Figure 29) from pump housing and drain fluid from pump. Remove all tubing connected to the control.

2. Remove the control by loosening four screws (1a) that hold the control to the valve block. Remove o–rings and discard.

3. Install the control into a vise with the jaws resting on the outside of body (7a).

4. Remove nuts (14a), then remove plugs (15a and 13a) with their associated o–rings (12a and 16a). Remove adjusting screws (11a), remove spring seats (10a), springs (9a and 18a) and spring guides (8a).

5. Remove plugs (4a) and associated o–rings (3a), remove spools (2a and 5a).

Follow the same inspection, repair and replacement procedure as outlined for the Industrial Control.

Assembly

Note

Obtain seal kit for the control (check service drawing for part number). Replace all seals and back up rings with new ones from the kit. Refer to Figure 13 during assembly. Special assembly procedures will be noted in the step–by–step procedure.

Lubricate all parts with system fluid at assembly. O–rings and back up rings require a viscosity improver to facilitate assembly.

1. Assemble spools (2a and 5a) into valve body (7a) with rounded end of spool pointing toward adjustment plug end of valve. Pressure compensating spool (5a) has five grooves versus three on the load sensing spool (2a). Make sure to note this distinction for proper assembly. Assemble o–rings (3a) on plugs (4a) and on plugs (15a and 13a) then thread plugs (4a) into body (7a). Torque plugs to 9.8–10.2 N.m. (7–7.5 lb.ft.).

2. Install parts (8a, 9a, 10a, 11a, 17a and 18a) in the order shown in exploded view.

3. Install plugs (13a and 15a) with their o–rings over spring guides (10a). Make sure adjusting screws (11a) are threaded through plugs (13a and 15a). Make sure adjusting screws (11a) are lubricated. Thread on nuts (14a).

CV Control (a)

Item	Description	Qty	Item	Description	Qty
1a	Screw	4	11a	Adjusting screw	2
2a	Load sensing spool	1	12a	O–Ring	1
3a	O–Ring	3	13a	Plug	1
4a	Plug	2	14a	Nut	2
5a	Pressure comp. spool	1	15a	Plug	1
6a	O–Ring	3	16a	O–Ring	1
7a	Control body	1	17a	Spring stop	1
8a	Spring guide	2	18a	Spring	1
9a	Spring	1	19a	Plug	1
10a	Spring Seat	2			

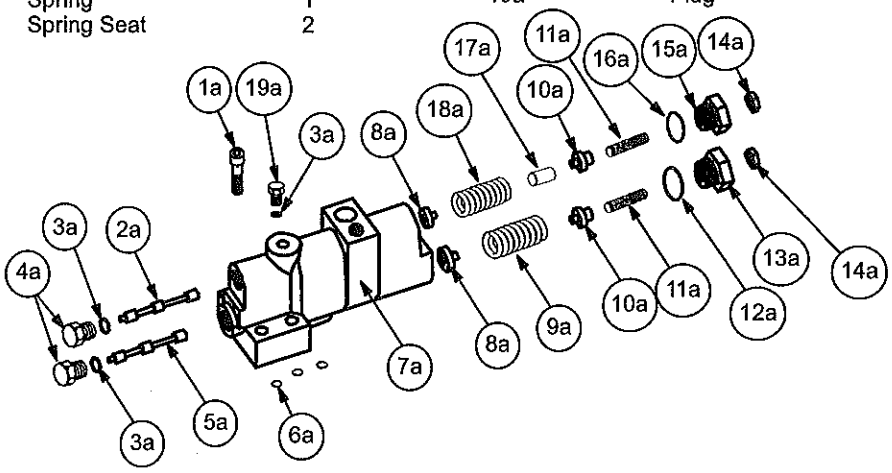


Figure 13: CV Control Exploded View

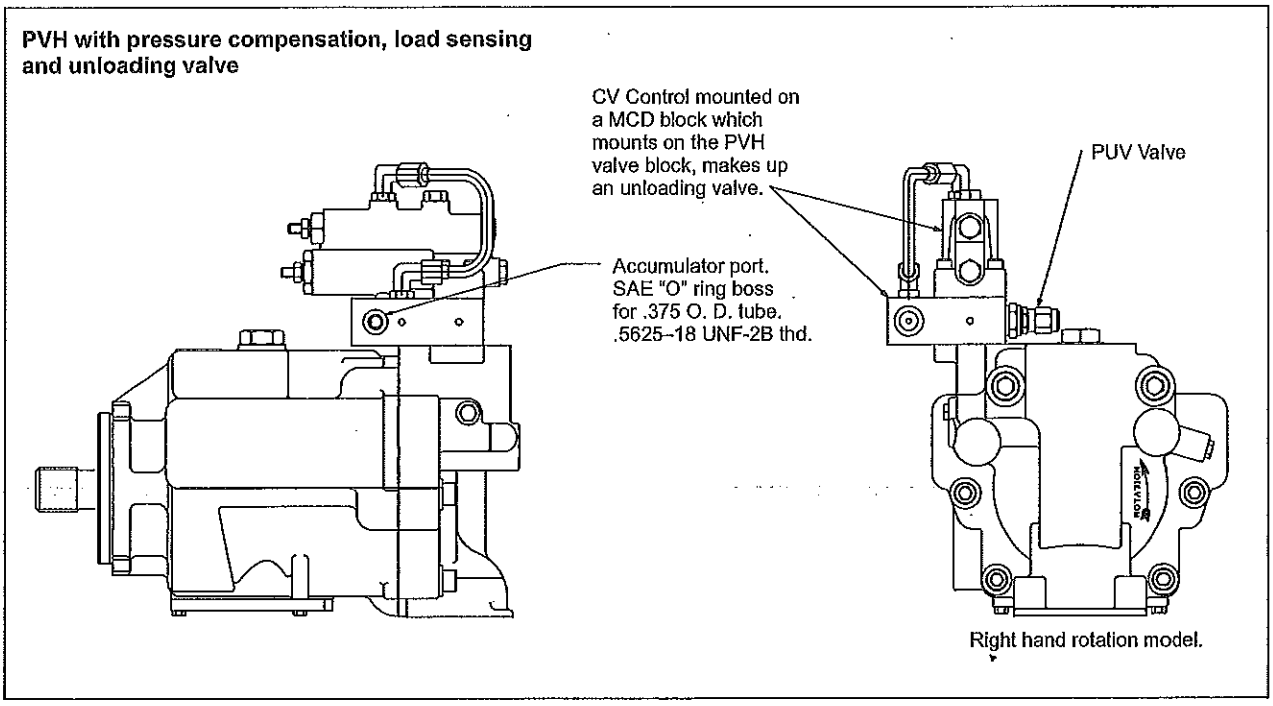


Figure 14: UV Unloading Control

Unloading Valve

Refer to Figure 14.

Refer to the overhaul procedure for the CV control. The MCD block and screw–in cartridge cannot be overhauled, replace if necessary.

Disassembly of Industrial Control

Refer to Figure 15.

Caution

DO NOT disassemble or remove control while engine is running. Make sure power is OFF and hydraulic cylinders are lowered. Discharge accumulators and block any load whose movement could generate pressure.

Note

In the following step if pump control is mounted at the 12 o'clock position, complete draining of the pump will not be required. Some draining will occur until fluid level reaches drain port level of the control.

1. Remove drain plug (47, see Figure 28) from pump housing and drain fluid from pump. Remove all tubing connected to the control.

2. Remove the control by loosening four screws (19) that hold the control to the valve block. Remove o–rings and discard.

3. Install the control into a vise with the jaws resting on the outside of body (17).

4. Remove nut (1) and adjusting screw (2), then remove nut (3) and associated o–ring (4). Remove spring guides, pin (not on PVH131), and spring (parts 5, 6, & 7). Discard o–rings.

5. Remove plugs (13 and14), remove and discard o–rings (12 and 15). Remove orifice plug (11) if necessary, and slide out spool (16).

Inspection, Repair & Replacement

Note

All parts must be thoroughly cleaned and kept clean during inspection and assembly. Clean all removed parts with a solvent that is compatible with system fluid. Compressed air may be used in cleaning, but must be filtered to remove water and contamination. Clean compressed air is especially useful in cleaning body passages.

Note

Replace all parts that do not meet the following specifications:

1. Inspect the threads and o–ring grooves and adjustment screw (2). If threads are worn, replace. If o–ring grooves have burrs, remove the burrs with an India stone.

2. Inspect spring (7) for wear on the outside edge of the spring. Check spring ends for squareness. The spring ends must be parallel within (3°). If spring is bent or worn, replace the spring.

3. Check spring guides (5) for burrs. Clean up with an India stone if burrs are present.

4. Check spool (16) for erosion, burrs, and scratches. If the spool is eroded or scratched across a land, check body (17) for the same problem. If erosion is heavy in both parts, replace the valve. If the spool is scratched and the scratch cannot be removed by light polishing with 500 grit paper or crocus cloth, replace both the body and spool. Clean up burrs with an India stone.

Note

Reliable operation throughout the specified operating range is assured only if genuine Vickers parts are used. Sophisticated design processes and materials are used in the manufacture of our parts. Substitutions may result in early failure.

Assembly

Note

Obtain seal kit for the control (check service drawing for part number). Replace all seals and back–up rings with new ones from the kit. Refer to Figure 15 during assembly. Special assembly procedures will be noted in the step–by–step procedure.

Lubricate all parts with system fluid at assembly. O–rings and back–up rings require a viscosity improver to facilitate assembly.

1. Assemble spool (16) into valve body (17) with rounded end of spool pointing toward adjustment plug end of valve. Assemble O–rings (12 and 15) on plugs (13 and 14), (install orifice plug 11 if removed) then, thread plugs (13 and 14) into body (17). Torque plugs (13 and 14) to 9.8–10.2 N.m. (7–7.5 lb.ft.).

2. Install spring guides (5), spring (7) and pin (6) into body (17). Install o–ring (4) over plug (3) and thread screw into body (17). Install adjusting screw (2) and nut (1).

Note

Reassemble the control to the pump and connect all tubing and applicable relief valves. Perform the final adjustment of control assembly.

IC Control

Item	Description	Qty	Item	Description	Qty
1	Nut	1	10	Plug	1
2	Adjusting screw	1	11	Orifice plug	1
3	Plug	1	12	O–ring	1
4	O–ring	1	13	Plug	1
5	Spring guide	2	14	Plug	1
6*	Pin (not used on PVH131)	3	15	O–ring	1
7	Spring	1	16	Spool	1
8	Plugs & O–rings	3	17	Body	1
9	Plug & O–ring	1	18	O–rings	3
			19	Screw	4

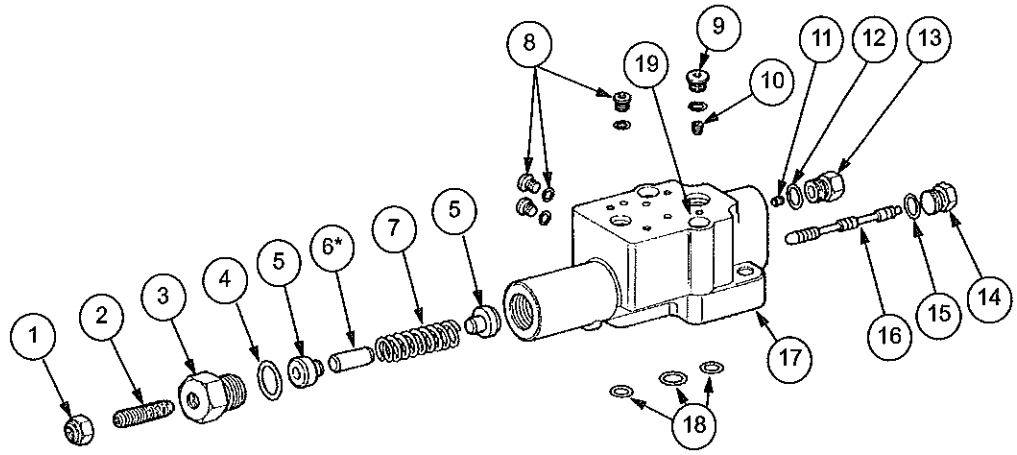


Figure 15: Industrial Control Exploded View

Disassembly CT Control

Refer to Figure 16.

Caution

DO NOT disassemble or remove control while engine is running. Make sure power is OFF and hydraulic cylinders are lowered. Discharge accumulators and block any load whose movement could generate pressure.

Note

In the following step if pump control is mounted at the 12 o'clock position, complete draining of the pump will not be required. Some draining will occur until fluid level reaches drain port level of the control.

1. Remove drain plug from pump housing and drain fluid from pump. Remove all tubing connected to the control.

2. Remove the control by loosening four screws (1d) that hold the control to the valve block. Remove the associated o–rings and discard.

3. Install the control into a vise with the jaws resting on the outside of body (4d).

Note

DO NOT remove adjusting screw (7d) and plug (6d) from cover unless a problem is found.

4. Remove screws (8d) and cover (9d) from body S/A (4d). Try not to rotate cover (9d) back and fourth during removal.

5. If spring guide (10d) is still located in cover (9d), pull the spring guide from the cover. Remove seals (11d and 12d) from the spring guide and seals (14d and 15d) from the cover. Discard the seals.

6. Tap cover (9d) against the work bench to remove pin (13d). If pin is stubborn, remove adjustment screw (7d), then, use a small brass rod and tap the pin from the cover. Insert 1/8" brass rod through the threaded hole of adjustment screw (7d).

7. Remove spring (16d) and spring seat (17d) from body S/A (4d).

8. Remove the torque limit parts as follows:

   a. Remove two screws (18d) and strap (19d) from body S/A (4d).

   b. Remove plug (20d) and slide pin (21d) from the end of plug. (NOTE: Tap end of spool with a brass rod to start plug out of body.) Remove seals (22d through 25d) and discard.

Follow the same inspection, repair and replacement procedure as outlined for the Industrial Control.

Assembly

Note

Obtain seal kit for the control (check service drawing for part number). Replace all seals and back up rings with new ones from the kit. Refer to Figure 16 during assembly. Special assembly procedures will be noted in the step–by–step procedure.

Note

Lubricate all parts with system fluid at assembly. O–rings and back up rings require a viscosity improver to facilitate assembly.

1. Place cover (9d) in a vise with o–ring groove pointing up and adjustment screw hole (7d) toward the technician.

2. Install o–ring (14d) and back-up ring (15d) on cover (9d) within the o–ring groove.

3. Install o–ring (12d) and back-up ring (11d) on plug (10d) and lubricate seals.

4. Insert pin (13d) into cover (9d). Make sure the plug is completely down into its bore. It may hang up on a ledge in the cover.

5. Place the end of spring guide (10d) into cover and slide down against the pin.

6. Place spring (16d) over the end of spring guide (10d) and set spring seat (17d) on top of the spring.

7. Pick up body (4d) and orient it with bottom interface up. Push spool toward the cover end opening to engage spring seat (17d). Gently slide body (4d) over the plug and spring parts and up against the cover. Install the four screws hand tight, then, test the spool for proper engagement with the spring guide. Use a length of brass rod for movement of the spool against the spring. The spool must bounce back or the spring seat is not in proper position. When the spring seat and spool are in position, place the body in the horizontal position and torque screws to 14.7–16 N.m. (11–12 lb.ft.).

8. If screw (7d) was removed, thread adjustment screw (7d) into cover (9d) until it is flush with cover. Install cover plug (6d).

9. Install o–rings (23d and 25d) and back-up rings (24d and 22d) on plug (20d). Back-up rings will be placed toward the ends of plug (20d).

10. Lubricate pin (21d) with petroleum jelly and insert into torque limiting plug (20d). Lubricate seals with a viscosity improver and insert the torque limiting plug into body S/A (4d). Make sure the pin does not fall out of torque limiting plug. (The plug must be held in the horizontal position during assembly.)

11. Assemble strap (19d) behind the plug and thread screws (18d) through strap into body S/A (4d). NOTE: Holes in strap are off center. Widest portion of strap from center holes will be placed toward the mounting face of body S/A (4d). Torque the screws to 30–38 N.m. (22–28 lb.ft.).

12. Install o–rings (5d) into body S/A (4d). Place cover (2d) over body S/A (4d) and insert screws (1d) through cover and into body S/A (4d). Place control in position on the pump valve body. Thread screws (1d) into pump and torque to 21–27 N.m. (15–20 lb.ft.). Make sure cover o–ring seals are located in-line with body openings.

CT Control (d)

Item	Description	Qty	Item	Description	Qty
1d	Screw	4	14d	O–Ring	1
2d	Cover	1	15d	Back–up ring	1
3d	O–Ring	4	16d	Spring	1
4d	Body S/A	1	17d	Spring seat	1
5d	O–Ring	5	18d	Screw	2
6d	Plug	1	19d	Strap	1
7d	Adjusting screw	1	20d	Plug	1
8d	Screw	4	21d	Pin	1
9d	Cover S/A	1	22d	Back–up ring	1
10d	Spring guide	1	23d	O–Ring	1
11d	Back–up ring	1	24d	Back–up ring	1
12d	O–Ring	1	25d	O–Ring	1
13d	Pin	1	26d	Pressure limiter screw	1

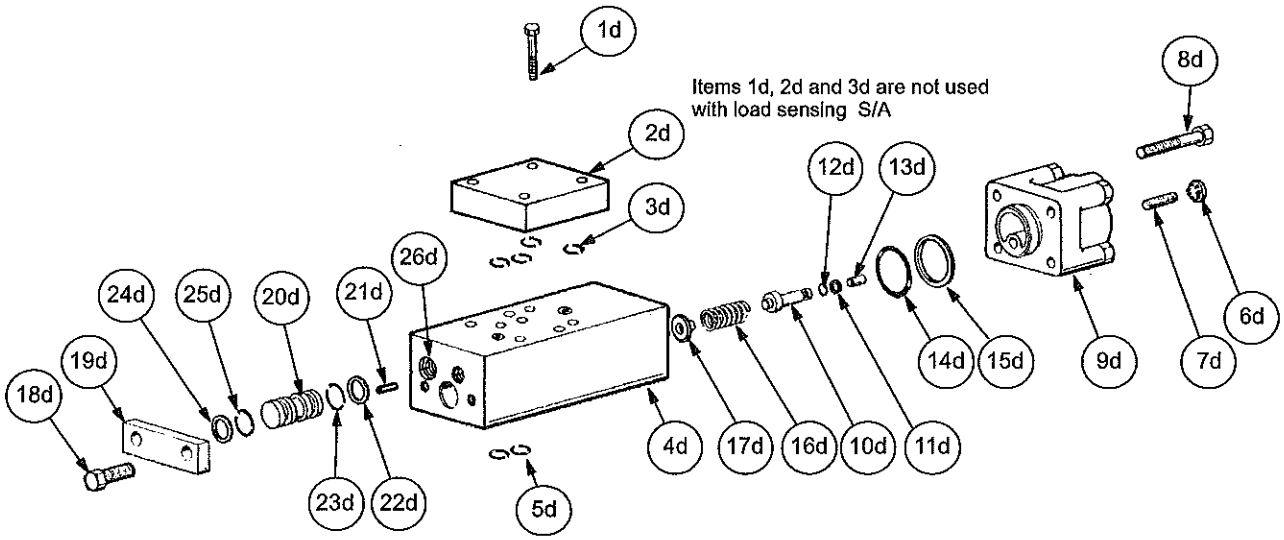


Figure 16: CT Control Exploded View

Disassembly Load Sensing Control (Refer to Figure 17)

Caution

DO NOT disassemble or remove control while engine is running. Make sure power is OFF and hydraulic cylinders are lowered. Discharge accumulators and block any load whose movement could generate pressure.

Note

In the following step if pump control is mounted at the 12 o'clock position, complete draining of the pump will not be required. Some draining will occur until fluid level reaches drain port level of the control.

1. Remove drain plug from pump housing and drain fluid from pump. Remove all tubing connected to the control.

2. Remove the control by loosening four screws (1c) that hold the control to the valve block. Remove the associated o–rings and discard.

3. Install the control into a vise with the jaws resting on the outside of body (2c).

4. Remove parts (4c through 9c), then remove plugs (10c and 13c) with their associated o–rings. Slide spool (12c) from the body and discard o–rings.

Follow the same inspection, repair and replacement procedure as outlined for the Industrial Control.

Assembly

Note

Obtain seal kit for the control (check service drawing for part number). Replace all seals and back up rings with new ones from the kit. Refer to Figure 17 during assembly. Special assembly procedures will be noted in the step–by–step procedure.

Lubricate all parts with system fluid at assembly. O–rings and back up rings require a viscosity improver to facilitate assembly.

1. Assemble spool (12c) into valve body (2c) with rounded end of spool pointing toward adjustment plug end of valve. Assemble o–rings (11c and 14c) on plugs (10c and 13c), then, thread plug (10c) into body (2c). Torque plug (10c) to 9.8–10.2 N.m. (7–7.5 lb.ft.).

2. Thread plug (13c) into body (2c) and torque to 29–32 N.m. (21–23 lb.ft.). Check RH/LH assembly position. Control position shown is for RH rotation.

3. Install spring (8c) over seat (9c) and insert spring and seat into valve body (2c).

4. Install back-up ring (7c) and o–ring (6c) on adjustment plug (5c or 5cc). Lubricate and thread adjustment plug (5c) into body (2c) until it is flush with face of body (-13 design). Adjust plug (5cc) full in then back off four turns (-14 design).

5. Insert cover (4c) over adjustment screw (5c, -13 design only). Thread nut (4cc) on adjustment screw (-14 design).

Torque Control/Load Sensing S/A (c)

Item	Description	Qty	Item	Description	Qty
1c	Screw	4	8c	Spring	1
2c	Body	1	9c	Spring seat	1
3c	O–Ring	4	10c	Plug	1
4c	Nut (–14 design)	1	11c	O–Ring	1
5c	Adj. Plug (–14 design)	1	12c	Spool	1
6c	O–Ring	1	13c	Plug	1
7c	Back–up ring	1	14c	O–Ring	1

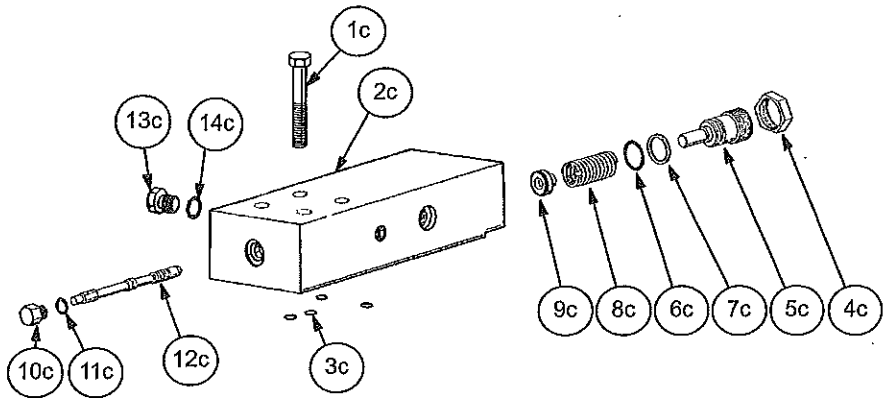


Figure 17: Torque Control/Load Sense S/A Exploded View

Section 4 – Installation

A. Lubrication

Internal lubrication is provided by the fluid in the system. Lubrication of shaft couplings should be as specified by their manufacturers. Coat shaft splines with a dry lubricant (Molycoat or equivalent) to prevent wear.

B. Mounting & Drive Connections

Caution

Pump shafts are designed to be installed in couplings with a slip fit. Pounding can damage the bearings.

1. Direct Mounting – A pilot on the pump mounting flange assures correct mounting and shaft alignment. Make sure the pilot is firmly seated in the accessory pad of the power source. Care should be taken in tightening the mounting screws to prevent misalignment.

2. Indirect drive is not recommended for these pumps without engineering approval.

C. Shaft Rotation

Shaft rotation (R or L) is specified by position 8 (page 4) of the model code which is stamped on the pump mounting flange.

Caution

Never drive a pump in the wrong direction of rotation. Seizure will result and cause expensive repairs.

D. Piping & Tubing

1. All pipes and tubing must be thoroughly cleaned before installation. Recommended methods of cleaning are sandblasting, wire brushing, pickling, and power flushing with a clean solvent to remove loose particles.

Note

For information on pickling, refer to instruction sheet 1221–S.

2. To minimize flow resistance and the possibility of leakage use only as many fittings and connections as necessary for proper installation.

3. The number of bends in tubing should be kept to a minimum to prevent excessive turbulence and friction of oil flow. Tubing must not be bent too sharply. The recommended minimum radius for bends is three times the inside diameter of the tube.

Section 5 – Service Maintenance

A. Inspection

All parts within the unit must be kept clean during the overhaul process. Handle each part with care and always work in a clean area.

The close tolerance of pump parts makes cleanliness very important. Clean all parts that are removed with a commercial solvent that is compatible with system fluid. Compressed air may be used in the cleaning process, however, it must be filtered to remove any water and any other contamination.

DO NOT remove retaining ring on the cylinder block (refer to Figure 19) because the cylinder block spring is under high compression. Bodily harm may result if the retaining ring is removed without adequate caution. In most cases, the parts inside the cylinder block will not require removal.

Inspect roller bearings for pitting and cracks. Turn roller bearings in their associated bearing race and check for roughness and binding. The roller bearings must turn freely within the bearing race with no signs of bind. If a roller bearing shows evidence of bind, wash the bearing in clean solvent and recheck. If binding persists, replace the roller bearing and bearing race.

Check each cylinder block bore for excessive wear. Use the piston and shoe subassembly for this purpose. The pistons should be a very close fit and slide in and out of the cylinder block bores. *NO BINDING CAN BE TOLERATED*. If binding occurs, clean the cylinder block and pistons. Lubricate the cylinder block bores with clean fluid and try again. Even minor contamination of the fluid may cause a piston to seize up in a cylinder bore.

Periodic inspection of the fluid condition and tube or piping connections can save time consuming breakdowns and unnecessary parts replacement. The following should be checked regularly:

1. All hydraulic connections must be kept tight. A loose connection in a pressure line will permit the fluid to leak out. If the fluid level becomes so low as to uncover the inlet pipe opening in the reservoir, extensive damage to the pump can result. In suction or return lines, loose connections permit air to be drawn into the system resulting in noisy and/or erratic operation.

2. Clean fluid is the best insurance for long service life. Therefore, the reservoir should be checked periodically for dirt or other contaminants. If the fluid becomes contaminated, the system should be drained and the reservoir cleaned before new fluid is added.

3. Filter elements also should be checked and replaced periodically. A clogged filter element results in a higher pressure drop. This can force particles through the filter which would ordinarily be trapped, or can cause the by-pass to open, resulting in a partial or complete loss of filtration.

4. Air bubbles in the reservoir can ruin the pump and other components. If bubbles are seen, locate the source of the air and seal the leak. (See IV in Table 2.)

B. Cleanliness

Thorough precautions should always be observed to insure the hydraulic system is clean:

1. Clean (flush) entire new system to remove paint, metal chips, welding shot, etc.

2. Filter each change of oil to prevent introduction of contaminants into the system.

3. Provide continuous oil filtration to remove sludge and products of wear and corrosion generated during the life of the system.

4. Provide continuous protection of system from entry of airborne contamination by sealing the system and/or by proper filtration of the air.

5. During usage, proper oil filling and servicing of filter, breathers, reservoirs, etc., cannot be over emphasized.

6. Thorough precautions should be taken by proper system and reservoir design, to insure that aeration of the oil will be kept to a minimum.

Vickers supports and recommends the hydraulic Systems Standards for Stationary Industrial Machinery advanced by the American National Standards Institute; ANSI/(NFPA/JIC) T2.24.1–1991. Key elements of this Standard as well as other vital information on the correct methods for treating hydraulic fluid are included in Vickers publication #561; "Vickers Guide to Systemic Contamination Control," available from your local Vickers distributor or by contacting Vickers, Incorporated. Recommendations on filtration and the selection of products to control fluid condition are included in this publication.

C. Sound Level

Noise is only indirectly affected by the fluid selection, but the condition of the fluid is of paramount importance in obtaining optimum reduction of system sound levels.

Some of the major factors affecting the fluid conditions that cause the loudest noises in a hydraulic system are:

1. Very high viscosities at start–up temperature can cause pump noises due to cavitation.

2. Running with a moderately high viscosity fluid will slow the release of air captured in the fluid. The fluid will not be completely purged of such air in the time it remains in the reservoir before recycling through the system.

3. Aerated fluid can be caused by ingestion of air through the pipe joints of inlet lines, high velocity discharge lines, cylinder rod packings or by fluid discharging above the fluid level in the reservoir. Air in the fluid causes a noise similar to cavitation.

4. A pump which is running excessively hot or noisy is a potential failure. Should a pump become noisy or overheated, the machine should be shut down immediately and the cause of improper operation corrected.

D. Hydraulic Fluid Recommendations

Oil in a hydraulic system performs the dual function of lubrication and transmission of power. It constitutes a vital factor in a hydraulic system, and careful selection of it should be made with the assistance of a reputable supplier. Proper selection of oil assures satisfactory life and operation of system components with particular emphasis on hydraulic pumps. Any oil selected for use with pumps is acceptable for use with valves or motors.

Data sheet M–2950–S for oil selection is available from Vickers Communications Department, Troy, Michigan.

Oil recommendations noted in the data sheet are based on our over 70 years experience in the industry as a hydraulic component manufacturer. Where special considerations indicate a need to depart from the recommended oils or operating conditions, contact your distributor or Vickers sales representative.

E. Adding Fluid to the System

When hydraulic fluid is added to the system, it should be pumped through a 10 micron absolute filter. The use of a porta–filter transfer unit (PFTU) to filter clean fluid into the system is recommended. For further information on the porta–filter transfer unit, obtain service drawing I–3952–S.

It is important that the fluid be kept clean and free from any substance that may cause improper operation or wear to the pump and other hydraulic units. Therefore, the use of cloth to strain the fluid should be avoided to prevent lint from entering the system.

F. Replacement Parts

Reliable operation throughout the specified operating range is assured only if genuine parts are used. Sophisticated design process and material are used in the manufacture of our parts. Substitutes may result in early failure. Part numbers are shown in the service parts drawings listed on page 3.

G. Product Life

The service life of these products is dependent upon environment, duty cycle, operating parameters and system cleanliness. Since these parameters vary from application to application, the ultimate user must determine and establish the periodic maintenance required to maximize life and detect component failure.

H. Fluid Cleanliness

Proper fluid condition is essential for long and satisfactory life of hydraulic components and systems. Hydraulic fluid must have the correct balance of cleanliness, materials and additives for protection against wear of components, elevated viscosity and inclusion of air.

Essential information on the correct methods for treating hydraulic fluid is included in Vickers publication 561; "Vickers Guide to Systemic Contamination control," available from your local Vickers distributor or by contacting Vickers, Incorporated.

Recommendation of filtration and the selection of products to control fluid condition are included in 561.

Recommended cleanliness levels using petroleum oil under common conditions is based on the highest fluid pressure levels in the system.

Piston pumps, regardless of manufacturer, will operate with fluids showing a higher cleanliness code. The operating life of the pump, and other components in the system, will be less however. For maximum life and best system performance, cleanliness codes as defined below should be achieved.

Fluids other than petroleum, severe service cycles or temperature extremes are cause for adjustment of these cleanliness codes. See Vickers Publication 561 for exact details.

System Pressure Level			
Product	1000psi	2000 psi	3000+ psi
Vane pumps, fixed	20/18/15	19/17/14	18/16/13
Vane pumps, variable	18/16/14	17/15/13	
Piston pumps, fixed	19/17/15	18/16/14	17/15/13
Piston pumps, variable	18/16/14	17/15/13	16/14/12
Directional valves		20/18/15	19/17/14
Proportional valves		17/15/12	15/13/11
Pressure/Flow controls		19/17/14	19/17/14
Cylinders	20/18/15	20/18/15	20/18/15
Vane motors	20/18/15	19/17/14	18/16/13
Axial piston motors	19/17/14	18/16/13	17/15/12
Radial piston motors	20/18/14	19/17/13	18/16/13

Section 6 – Troubleshooting

The troubleshooting chart (Table 2 below) lists common difficulties experienced with pumps and hydraulic systems. The chart indicates probable causes and remedies for each of the troubles listed.

Trouble	Probable Cause	Remedy
I. Excessive noise in pump.	Low oil level in reservoir.	Fill reservoir to proper level with the recommended fluid. **DO NOT** over fill or damage may result.
	Air in the system.	1. Open reservoir cap and operate hydraulic system until purged. 2. "Bleed" hydraulic lines at highest point downstream of pump while system is under pressure.
	Vacuum condition.	Check inlet (suction) lines and fittings for leaks.
	Oil too thick.	Be certain correct type of oil is used for refilling or adding to the system.
	Cold weather.	Run hydraulic system until unit is warm to the touch and noise disappears.
II. Hydraulic pump overheating.	Internal leakage.	If established that excessive internal leakage exists within the pump, return to maintenance shop for evaluation and repair.
	Heat exchanger not functioning.	Locate trouble and repair or replace.
	Fluid level low.	Add oil to proper operating level.
III. System not developing pressure.	Compensator malfunction	Replace or repair.
	Loss of fluid internally (slippage).	Return to maintenance shop for evaluation and repair.
IV. Loss of fluid	Ruptured hydraulic line.	Check all external connections, tubing and hoses. Tighten connections, replace ruptured tube or hose.
	Leaking gaskets or seals in the system.	Observe mating section of pump for leaks. Replace seals or gaskets if possible. Check all system components for leaks.
V. Miscellaneous.	Broken or misadjusted pump control.	Adjust or replace pump control.
	Disconnected or broken drive mechanism.	Locate and repair.

Table 2. Troubleshooting Chart

Section 7 – Pump Overhaul

A. General

In most cases, the pump will not require a complete overhaul as described within this section. If the pump needs a complete overhaul, use the service tools listed below. Repair of this unit is intricate and should not be attempted without proper tools.

B. Required Tools

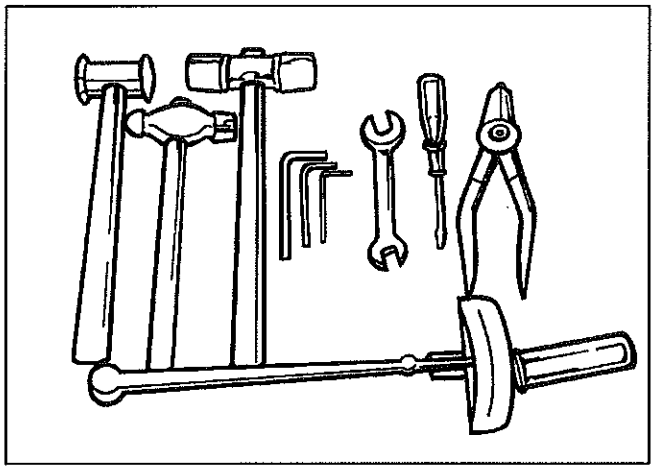


Figure 18: Standard Tools

Standard tools for disassembly.

- Ball peen hammer
- Plastic tip hammer
- Hex (Allen) wrenches
- Wrenches
- Flat tip screw driver
- Lock ring pliers
- Torque wrench
- Rubber tip hammer
- Petroleum jelly
- Cleaning solvent

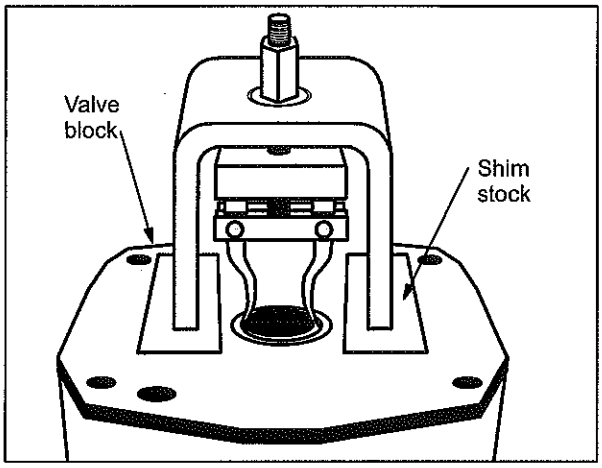


Figure 20: Valve Block Bearing Race Removal Tool w/shim stock

Special tools.

- Dial indicator and accessories
- Bearing race removal tool and shim stock (see Figure 20)
- Cylinder block spring decompression tool (see below)
- Shaft seal assembly tool (see Figure 22)
- Force indicator tool
- Bearing race installation tool (see Figure 23)
- Shim stock or teflon material 8" x 3" x .003"
- 2 Studs (8" long x 0.437–14 dia./C1–2A thd. class)

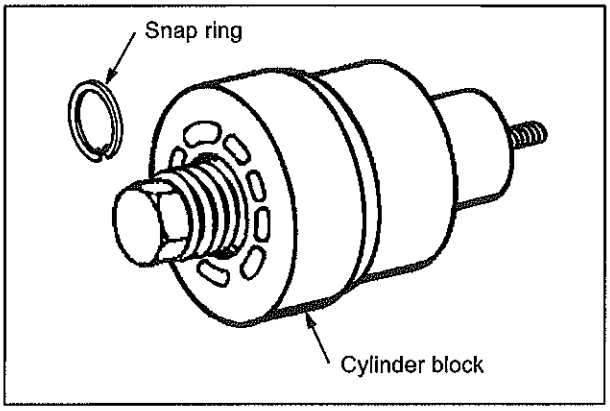


Figure 19: Cylinder Block Disassembly Tool. (Tighten nut, remove snap ring, loosen nut to relieve spring tension.)

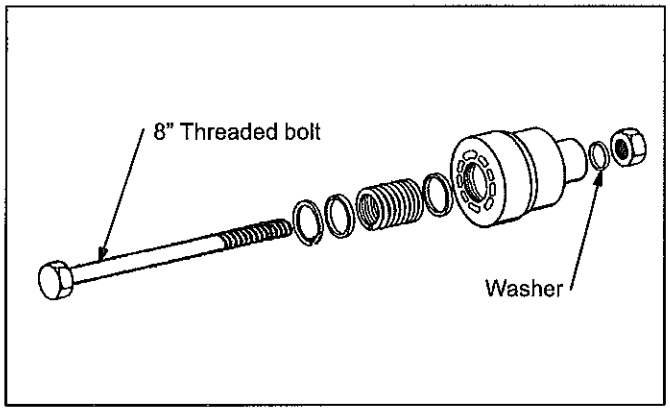
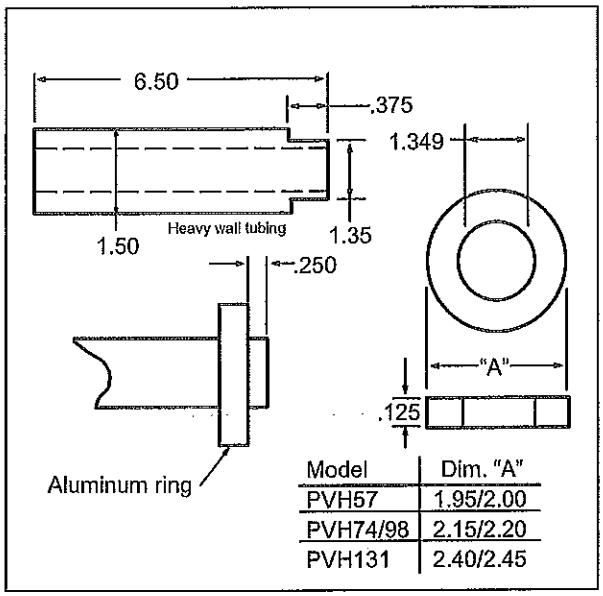


Figure 21: Cylinder Block Subassembly Parts

Required Tools (con't.)



Model	Dim. "A"
PVH57	1.95/2.00
PVH74/98	2.15/2.20
PVH131	2.40/2.45

Figure 22: Shaft Seal Driver

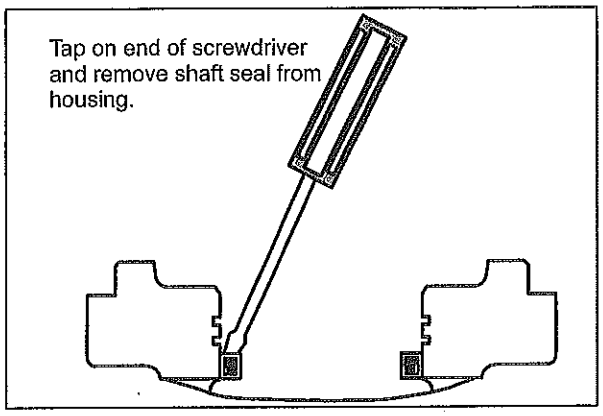


Figure 24: Shaft Seal Removal.

Refer to Figure 29.

Model	Bearing Race Item #	Dim. "A"	Dim. "B"	Dim. "C"
PVH57	23	4.00	1.98/2.00	0.98/0.99
	44		2.70/2.80	1.50/1.60
PVH74	23	4.00	2.10/2.20	1.00/1.10
	44		2.75/2.85	1.45/1.55
PVH98	23	4.00	2.30/2.40	1.00/1.10
	44		3.15/3.25	1.65/1.75
PVH131	23	4.00	2.50/2.60	1.20/1.30
	44		3.40/3.50	1.80/1.90

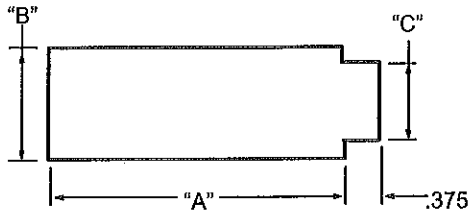


Figure 23: Bearing Race Installation Tool

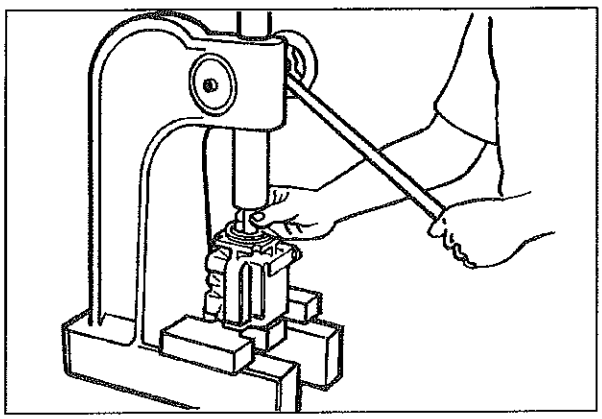


Figure 25: Removal of Front Bearing Race

C. Unit Removal

Refer to Figure 29.

1. Block the machine to prevent uncontrolled movement.

Caution

Before breaking the circuit connection, make sure power is OFF and system pressure is released. Lower all vertical cylinders, discharge accumulators, and block any load that could generate pressure.

2. Drain the fluid from the system.

3. Remove drain plug (1) from the pump's valve block (8) and drain the fluid from the pump.

4. Before breaking any circuit connections at the pump, clean the pump exterior to prevent dirt from entering the system.

5. Disconnect all hydraulic lines at the pump.

6. Remove the unit from the machine.

7. Put the unit on a clean, work bench that will support the unit's weight.

8. Before unit disassembly, cap or plug all open circuit connections on the machine so dirt does not enter the system.

D. Unit Disassembly

Note

All parts within the unit must be kept clean during the overhaul process. Handle each part with great care. The close tolerance of the parts makes this requirement very important. Clean all parts that are removed from the unit with a commercial solvent that is compatible with the system fluid. Compressed air may be used in the cleaning process, however, it must be filtered to remove water and other contamination.

Valve Block Disassembly

Note

Refer to Figure 29, PVH exploded view, for the following disassembly procedure.

1. Remove plug (3) and o–ring (4) from valve block (8).

2. Loosen six screws (5, 6, 7) that attach the valve block to the pump housing (51).

3. At this time, remove two screws (6 and 7) that are opposite of each other and replace these screws with two eight inch studs. The studs are referenced under Special Tools at the beginning of this section.

4. Remove the remaining four screws from the valve block.

5. Remove the valve block from the pump housing.

Note

To dislodge valve block (8) from pump housing (51), tap on side of valve block with a rubber hammer. Slowly remove the valve block away from the housing. The studs will act as a guide during this procedure. (Note: The valve plate (21) may stick to cylinder block (29) or valve block (8) during removal of the valve block.) Be careful not to damage the valve plate or valve block during this operation. Once the valve block moves away, do not allow the valve block to move back against the pump housing (51) because the valve plate may get damaged.

6. Remove valve plate (21).

7. Remove and discard housing gasket (20).

8. Remove pins (19) from valve block (8).

9. Remove control piston (9), bias piston (12), and bias spring (13). *DO NOT* remove control rod (10), o–ring (11), bias rod (14), and o–ring (15) from valve block (8) unless they are damaged.

Note

If control rod (10) or bias rod (14) need to be removed from valve block (8), secure the valve block in a sturdy vise. Make sure the vise jaws do not damage the valve block face. Insert a hex key wrench into the stem and turn the wrench counterclockwise. It may be necessary to use an extension on the wrench because the control and bias stem are secured to the valve block with Loctite 270 cement. Remove o–ring (11) and o–ring (15) from the rods.

10. Take a blunt screwdriver and push down on poppet (17). The poppet is located in the valve block face underneath seat (16).

Release the screw driver from the poppet and check to see if the poppet returns against seat (17). *DO NOT* remove seat (16), poppet (17), and spring (18) from valve block (8) if the poppet returns against the seat.

11. Remove tail roller bearing (23) and shim (22) from ends of shaft (39).

Maximum Displacement Stop Removal
Refer to Figure 29.

1. Remove lock nut (52).

2. Slide control piston (9) off control rod (10).

3. Unscrew adjusting screw (54) from valve block (8a).

Feedback Control Removal
Refer to Figure 29.

1. Unscrew feedback plug (67) from valve block (8b).

2. Remove screw (57) and retaining ring (58), slide spool seat (59) off bias piston (56).

3. Remove spring (55) and bias rod (14). (Refer to Note on page 26).

4. Remove feedback spool (61), and slide out sleeve (66).

Rotating Group Removal

1. Remove the three screws (26) that hold the lower bearing cover (27) to pump housing (51). Remove lower bearing cover and o–ring (28). Discard o–ring (28). Rotating group cannot be removed with the yoke. Remove screws first and then remove rotating group.

2. Reach in with both hands and remove the complete rotating group from housing (51). The complete rotating group consists of items 29 through 40.

3. Remove four screws (34) and limiter plates (35) to remove the rotating group from yoke (40).
(yoke assy. consists of 2 limiter plates, 2 spacers and 4 screws)

Warning

DO NOT remove retaining ring (30) from cylinder block (29) because spring (32) is under high compression. Bodily harm may result if the retaining ring is removed without adequate caution. In most cases, the parts inside the cylinder block will not require removal. However, if spring (32) is damaged, the parts within the cylinder block must be removed. See Figure 19 for disassembly instructions.

Shaft and Yoke Removal

Note

Shaft (39) removal is necessary if any of the following conditions are noticed:
a) Damage at bearing surface or spline area of shaft (39).
b) Yoke (40) bind (i.e. yoke does not move freely back and forth within the pump housing.
c) Yoke shows evidence of heavy wear or cracks.
d) Yoke saddle bearing (42 and 43) surfaces are worn, scored or defective.
e) Shaft seal (46) leakage during operation.

Note

If any of the above conditions are noted, perform the following steps.

1. Remove three screws (26) from lower bearing cover (27), then remove cover and upper bearing plug (24).

2. Remove four screws (34) and limiter plates (35) so that the rotating group can be separated from yoke (40).

3. Secure housing (51) in a vise so that shaft (39) is in a horizontal position.

4. Remove shaft (39) from housing (51) by tapping on spline end of shaft with a rubber hammer.

5. Remove yoke (40) from housing (51).

6. Wash yoke (40) with clean solvent.

Bearing and Shaft Seal Removal

1. Remove roller bearing (46) from housing (51). Also remove saddle bearings (42 & 43) and inspect for wear.

2. Inspect roller bearings (23 and 44) for pitting and cracks. Turn roller bearings in their associated bearing race and check for roughness and bind. The roller bearings must turn freely within the bearing race with no signs of bind. If a roller bearing shows evidence of bind, wash the bearing in a clean solvent and recheck for bind. If binding persists, replace the roller bearing and race. Refer to Figures 19 and 24 for the bearing race removal procedure.

3. Remove retaining ring (45) from housing (51) with Truarc pliers.

4. Remove shaft seal (46) from housing (51). Refer to Figure 24 for instructions.

E. Inspection, Repair & Part Replacement

Note

Before inspection of parts, clean with a solvent that is compatible with system fluid.

Rotating Group Parts (Refer to Figure 29)

1. Inspect cylinder block face (8) for wear, scratches, and/or erosion. If cylinder block condition is questionable, replace the entire rotating group.

2. Check each cylinder block bore for excessive wear. Use the piston and shoe S/A (37) for this purpose. The pistons should be a very close fit and slide in and out of the cylinder block bores. *NO BINDING CAN BE TOLERATED.* If binding occurs, clean the cylinder block and pistons. Lubricate the cylinder block bores with clean fluid and try again. Even minor contamination of the fluid may cause a piston to freeze up in a cylinder bore.

3. Inspect each of the nine piston and shoe subassemblies (31) for a maximum end play of 0.005 inch between the piston and shoe. Also check the face dimension of each shoe. The face dimension must be within 0.001 inch. See Figure 26.

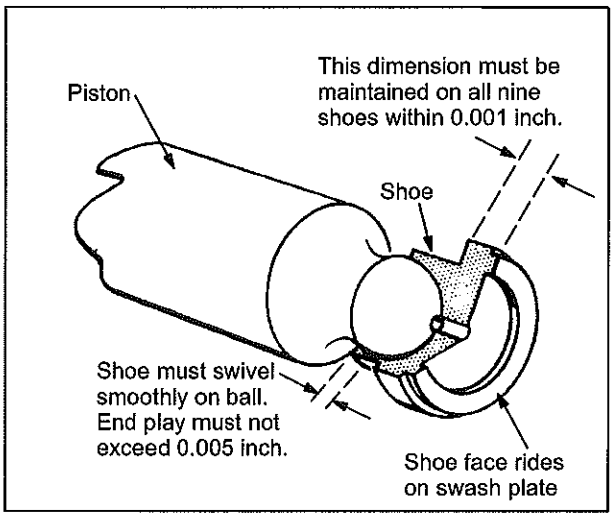


Figure 26: Piston S/A Tolerances

4. Inspect the shoe plate (36) for heavy wear and cracks. If heavy wear and/or cracks are found, replace the shoe plate.

Valve Block & Associated Parts

1. Inspect valve block (8) for erosion, cracks, and burrs. Clean up minor burrs with an India stone. If erosion or cracks are found, replace the valve block.

2. Inspect roller bearing and bearing race (23) for nicks and pitting. Make sure the roller bearing turns freely within the bearing race. If the roller bearing needs replacement, both the roller bearing and the bearing race must be replaced. To remove bearing race from valve block, refer to Figure 25.

3. Inspect valve plate (21) for erosion, excessive wear, heavy scratches, and cracks. If any of the above conditions are found, replace the valve plate.

4. Inspect control and bias piston parts (9 through 15), feedback control parts (55 thru 68), and maximum displacement stop parts (52, 53, 54, 9, 10) for burrs, scratches and cracks. Clean up minor scratches with 500 grit paper. Remove burrs with an India stone. The control and bias piston (9, 12 and 55) should move freely over the respective control stem and bias rods (10 and 14.)

Yoke Parts

1. Inspect yoke (40) face for wear, roughness or scoring. Check the yoke hubs and bearing surfaces for wear and cracks. Replace yoke, if defective.

2. Inspect limiter plate (35) and spacers (38) for heavy ware and cracks. Replace if defective.

3. Inspect saddle bearing surfaces (42 and 43) for wear, pitting, and smooth operation. Replace if necessary.

Shaft/Housing Parts

1. Inspect drive shaft (39) for wear, stripped splines, and burrs. Remove burrs with an India stone. Inspect the contact area of bearing (44) and shaft seal (46). Replace the drive shaft if wear or scoring is greater than 0.005 T.I.R. (total indicator reading).

2. Inspect drive shaft bearing (44) for roughness, pitting of rollers, and excessive end play. Replace, if defective. If the bearing needs to be replaced, the bearing race inside housing (51) also requires replacement. To remove the bearing race from the housing, refer to Figure 25.

3. Inspect housing (51) mounting flange for nicks and burrs. Remove minor nicks and burrs with an India stone. Also check the housing for damaged or stripped threads. If any thread is damaged, replace the housing.

4. Check remaining pump parts for excessive wear, damaged threads, burrs, cracks and erosion. Replace any part that is in questionable condition.

F. Assembly

Assembly is generally performed in the reverse order of disassembly. Refer to Figure 29 during the following assembly procedure.

Note

Obtain a new seal kit. Refer to the appropriate part drawing as listed on page 4 for the seal kit part number. Apply a light film of clean hydraulic fluid to the new seals. This will make assembly easier and also provide initial lubrication of moving parts.

Model	Plug #	Torque (Nm)	Torque (lb.ft.)
PVH57/74	1	54–59	40–43
	3	15–16	11–12
PVH98	1	75–83	55–61
	3	15–16	11–12
PVH131	1	41–49	30–36
	3	14–19	10–14

Table 3: Plug Torque
(refer to Figure 29)

Assemble the piston pump as follows:

1. If shaft seal (46) was removed, install a new shaft seal into housing (51). Lubricate the shaft seal and housing bore with petroleum jelly before assembly. Use an arbor press and the shaft seal assembly tool. The shaft seal assembly tool is shown in Figure 22. Make sure the spring member of the shaft seal is face up during assembly.

2. Install retaining ring (45) into the second groove within the housing bore next the shaft seal. Use Truarc pliers for this operation.

Note

Bearing (race and rollers) are to be treated as one part. Therefore, when replacing bearings, install new rollers and race. Do not try to use old races over again.

3. If bearing race was removed from housing (51) install a new bearing race into housing with an arbor press. Make sure the bearing race is face up to accommodate the matching roller bearing. Press the bearing race until it rests at bottom of housing. Use the bearing race tool as shown in Figure 27. After the bearing race is installed, apply a liberal amount of petroleum jelly to the matching roller bearing. Install the roller bearing into the bearing race.

4. Apply a thin coat of clean hydraulic fluid to limiter plate (35), spacers (38) and piston/shoe S/A (36 and 37). Align piston/shoe S/A (36 and 37) with yoke (40) and install using screws (34).

Note

The following step describes the assembly of shaft (39) into housing (51). Refer to Figure 28 during this process.

5. If yoke (40) was removed from housing (51), assemble the yoke into housing as follows:

a. Place the pump housing on its side with saddle bearing surface (42 and 43) area of the housing face up.

b. Insert yoke (40) into housing (51).

c. Lubricate yoke bearing surfaces (42 and 43) with clean hydraulic fluid. Orient the bearing to match the bearing race. Next, carefully insert the yoke into the pump housing. *DO NOT* force the yoke into place if it does not fit properly. Align the yoke bearing surfaces with the saddle bearings.

6. Install shaft (39) as follows:

a. Lubricate roller bearing (44) and shaft (39). Assemble roller bearing (44) on shaft (39).

b. Take a piece of shim stock or Teflon material (8" x 3" x .003") and roll it into a funnel shape. Insert the Teflon material into the shaft seal (46) as shown in Figure 28.

c. Install shaft (39) into housing (51). (Note: The Teflon material will be forced out of shaft during this process.)

Note

The following step describes the shaft and end play procedure. Final shaft end play must be 0.001–0.004. This must be done without the rotating group installed.

7. Obtain a shaft spacer kit as noted in the parts drawing.

Perform the following steps:

a. If bias and control parts (9 through 15 – except 10 & 14) are attached to valve block (8), remove parts.

Note

The bias and control rods must be bonded to the valve block during assembly, using a suitable bonding compound.

b. If pins (19) were removed, install two new pins into valve block (8).

c. Install housing gasket (20) against valve block (8).

d. Install tail bearing (23) on end shaft (39) so the bearing rollers match up with bearing race within valve block (8).

Note

If bearing race was removed from valve block, install a new bearing race into valve block. *DO NOT* reuse bearing races with new rollers. Refer to Figure 27 for instructions.

e. Position valve block (8) on the two studs and carefully slide the valve block against housing (51). Make sure mounting pins (19) engage properly into valve block.

f. Apply a small amount of hydraulic fluid to screws (5 through 7) threads. Secure the valve block (8) to housing (51) with six screws (5 through 7). Tighten screws to 63.8 – 77.8 Nm.

g. Set the pump on the work bench so that shaft (39) is straight up (vertical). Push down on shaft to insure bearings (23 and 44) are seated.

h. Place a dial indicator at end of shaft (39). Set the dial indicator to 0.00.

i. Place vise grip pliers underneath shaft spline and lift up on shaft (39).

j. Observe the dial indicator reading to determine the amount of shaft movement. For example, if the dial indicator needle reads 0.040, a 0.036-0.039 shim (22) must be added to the end of shaft to obtain a 0.001-0.004 shaft end play (0.040 minus 0.036-0.039 = 0.001-0.004). Repeat this step two times to insure proper measurement.

k. Remove valve block (8) from housing (51). Remove tail bearing (23) from end of shaft (39).

l. Install shim (22) to end of shaft (39) according to the measurement obtained in step "j".

m. Install tail bearing (23) on end of shaft (39) next to shim (22).

n. Repeat steps "a" through "j". If 0.001-0.004 shaft end play is obtained, proceed to step "o".

o. Remove valve block (8), tail bearing (23), and shim (22) from pump. Set these aside for final assembly.

8. Remove lower bearing cover (27) and upper bearing plug (24) from housing (51).

9. If required, assemble rotating group parts 29 through 40 into cylinder block (29). Use the spring compression tool as shown in Figure 21.

10. Lubricate cylinder block (29) with clean hydraulic fluid. Install the nine piston subassemblies (37) into shoe plate (36) as shown in Figure 26.

11. Feed nine pistons (37) into the cylinder block bores. Then install rotating parts 29 through 40.

12. Align rotating group with the yoke (40) subassembly. Add spacers (38) and limiter plates (35) and attach to yoke (40) with four screws (34). Seat yoke (40) on saddle bearings (42 and 43).

13. Install upper bearing plug (24) and lower bearing cover (27) and tighten three screws (26) to 7.5-9.5 Nm.

14. Install tail bearing (23) on shaft (39) next to shim (22).

15. If required, assemble o-ring (15) on bias rod (14) and o–ring (11) or control rod (10). Apply one drop of Loctite 270 cement to bias rod and control rod threads. Install the bias and control rods into valve block (8). Secure the stems with a hex key wrench.

16. Assemble adjusting screw (54) with o–ring (53) into valve block. Slide control piston (56) on control rod (55). Install lock nut (52).

17. Assemble spring (13) and piston (12) on bias rod (14). Install piston (9) on control rod (10).

18. Insert pins (19) into valve block (8).

19. Lubricate valve block face with a light film of clean hydraulic fluid.

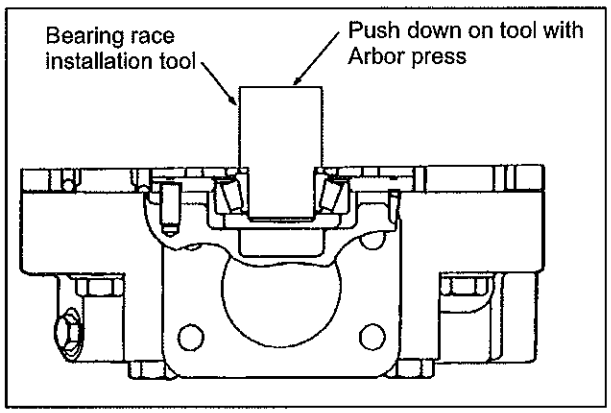


Figure 27: Installation of Bearing Race into Valve Block

20. Place valve plate (21) on valve block face with bronze side face up.

21. Carefully assemble valve block (8) onto housing (51). Make sure the bias spring (13) and bias piston (12) are in place against the yoke subassembly during the assembly process. If the spring or piston falls off bias rod (14), apply a liberal amount of petroleum jelly to the spring and piston to hold them in place.

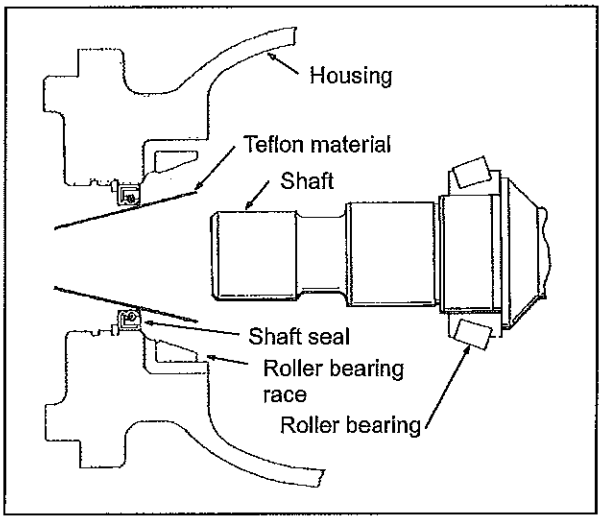


Figure 28: Shaft Installation

22. Install screws (6 and 7) hand tight. Remove the two 8" alignment studs from housing (51) and install the remaining two screws (5). Cross tighten the screws to 63.8-77.8 Nm.

23. Assemble o–rings (2 and 4) on plugs (1 and 3). Install the plugs into valve block (8). Tighten the plugs to valve noted in Table 3.

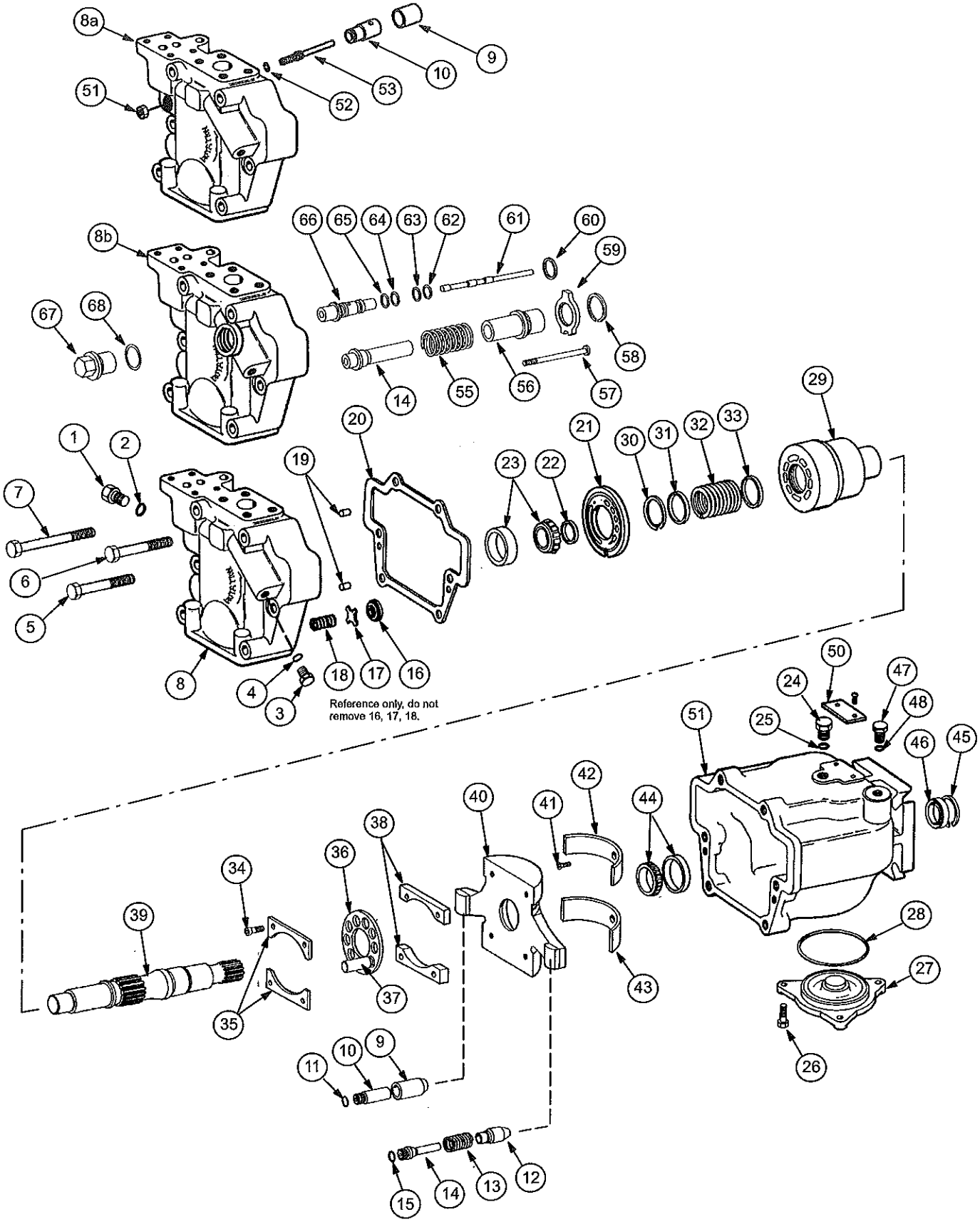


Figure 29: Exploded View of PVH Pump

A. Test Conditions

1. Fluid entering the pump inlet must be filtered to meet an ISO cleanliness code of 14/12 or cleaner. Selections from OFP, OFR and OFRS series filters are recommended. For recommended fluid types, refer to bulletin M–2950–S.

2. Pump inlet pressure must be maintained between 1.15 bar and 0.85 bar absolute pressure (2 PSIG, 5 inches HG.)

3. Operate the pump at a fluid temperature of 120°F ±10°F.

4. PVH operating parameters are listed in Table 4.

Pump Model	Rated Pressure bar (psi)	Rated Speed (rpm)	Rated Displacement ml/rev (CIR)
PVH57	250 (3600)	2400	57 (3.5)
PVH57QI	250 (3600)	1800	57 (3.5)
PVH74	250 (3600)	2200	74 (4.5)
PVH74QI	250 (3600)	2200	74 (4.5)
PVH98	250 (3600)	2100	98 (6.0)
PVH98QI	250 (3600)	1800	98 (6.0)
PVH131	250 (3600)	2000	131 (8.0)
PVH131QI	250 (3600)	1500	131 (8.0)

Table 4: PVH Operating Parameters

B. Preliminary Set–up

1. If a hydraulic test stand is available with adequate horsepower capabilities, mount the pump on the test stand. If a test stand is not available, mount the pump on the vehicle and proceed to connect the hydraulic lines to the pump. Refer to page 22, Section 4 for pump installation instructions.

2. Connect the case line, inlet and outlet line, load sensing line (if required), pressure gauges, and other equipment as described in Figure 30. Make sure all connections are tight.

3. Remove drain plug (1) from valve block (8) and fill the pump with clean hydraulic fluid. Reinstall the plug and torque to value noted in Table 3.

Note

The following step describes the preliminary setting of the PVH control adjustment screws prior to test. Refer to Figures 12 thru 17 for screw locations.

4. Turn the control adjustment screws as follows:

For C Control, turn pressure compensating adjusting screw (5b, Figure 12) until bottomed.

For CV Control, turn load sensing and pressure compensator adjusting screw (11a, Figure 13) in until bottomed.

For UV Control, turn load sensing and pressure compensator adjusting screw (11a, Figure 13) in until bottomed. DO NOT adjust unloading valve, it is preset from the factory.

For Industrial Control, turn adjusting screw (2, Figure 15) in until bottomed.

For load sensing, torque limit and pressure limit controls, turn torque limiting adjusting screw (7d, Figure 16) and load sensing adjusting screw (5c, Figure 17) in until bottomed.

C. Operating Tests & Calibration

C Control: (refer to Figure 30)

1. Fully open load valve A.

2. Operate unit at rated speed as specified in Table 5 and adjust outlet pressure to 28 bar (400 psi) until all air is removed from the circuit.

3. Increase unit outlet pressure to 150 bar (2175 psi) and hold for 1 minute followed by 15 seconds at 28 bar (400 psi). Increase the outlet pressure to 250 bar (3625 psi) for 1 minute. Unit must be able to meet flow and flow loss requirements as specified in Table 5 at both conditions unless unit is at reduced stroke.

Pressure limiting and case–to–inlet check valve calibration.

1. With valve A closed, adjust the pressure limiting setting to the pressure specified by the model code ±4.0 bar (58 psi). If no pressure is specified, set the pressure compensator to 250 ±4.0 bar (3625 ±58 psi) at zero outlet flow.

2. With pump at rated speed, maximum flow, and outlet pressure of 28 bar (400 psi), close valve a rapidly. There should be no indication of yoke hunting or pump instability. Instability is evidenced by sustained pump outlet pressure oscillations greater than ±3.5 bar (50 psi) about nominal pressure limiting setting. With valve A closed, the pressure should be within ±4.0 bar (58 psi) of initial setting mentioned in paragraph 1.

3. Operate pump at rated speed with valve A closed and unit operating at pressure limiter setting. Block off case drain flow by closing valve c. The case pressure should be maintained at 0.9-1.7 bar (13-25 psi) above inlet pressure.

4. Plug all ports and apply air to case at a pressure of 3.5 bar (50 psi) while unit si immersed in a non-corrosive fluid. No external leakage is permitted.

CV Control: (refer to Figure 30)

1. Fully open valve G and V.

2. Fully open valve B and set valve A to minimum pressing setting.

3. Start the test stand or vehicle engine. Operate the pump at 600 rpm and at minimum outlet pressure. Check the system for leaks and unusual noise. Increase rpm's to 1200 until all the air is purged out of the system.

Caution

If unusual noise is noted, shut down the system immediately to avoid pump damage. Refer to the Troubleshooting chart (Table 2) for possible repair solution.

4. Increase the pump to the rated speed (rpm) as specified in Table 6. Adjust valve A until 28 bar (400 psig) outlet pressure is obtained at P2. Hold this condition until air is purged out of the system.

5. Increase the outlet pressure to 150 bar (2175 psig). Hold this condition for one minute. Reduce the outlet pressure to 28 bar (400 psig) and observe the pump flow from flowmeter F. Pump flow must meet the requirement as stated in Table 5 when the fluid temperature at pump outlet is 120°F ±10°F.

6. Increase the pump outlet pressure to 250 bar (3625 psig). The pump must be able to meet the flow loss requirement as shown in Table 5. Hold this condition for one minute.

7. Visually inspect shaft seal (46) for leakage throughout the performance test.

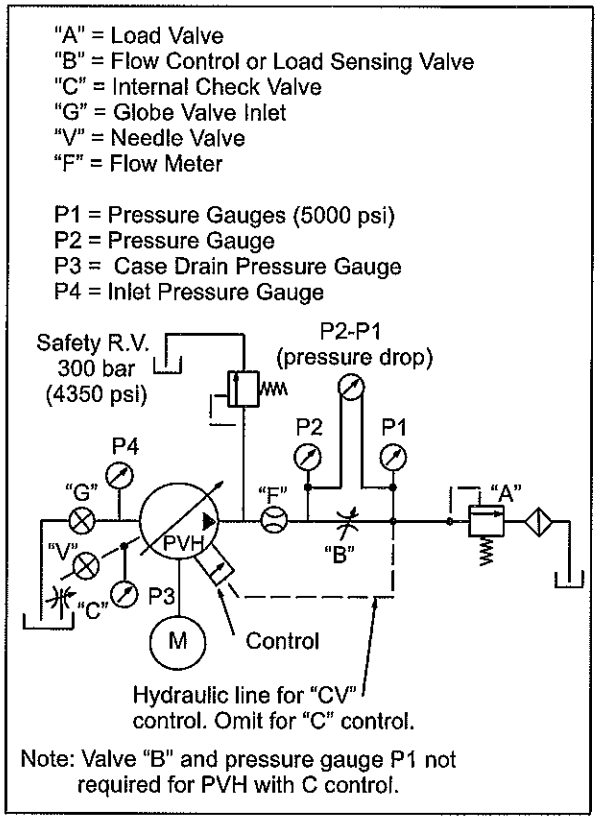


Figure 30: C, CV Control Test Circuit

Pump Model	Rated Speed (rpm)	Flow @28 bar (400 psi)	Max. Flow Loss @250 bar (3625 psi)
PVH57	2400	130 - 144 l/min (34.3 - 38 USgpm)	12 l/min (3.2 USgpm)
PVH57QI	1800	95.8 - 10.9 l/min (25.3 - 29.3 USgpm)	12 l/min (3.2 USgpm)
PVH74	2200	154.1 - 171 l/min (40.7 - 45.2 USgpm)	13 l/min (3.4 USgpm)
PVH74Q	2100	145 - 160 l/min (38 - 42 USgpm)	13 l/min (3.4 USgpm)
PVH74QI	1800	126.1 - 139.2 l/min (33.3 - 36.8 USgpm)	13 l/min (3.4 USgpm)
PVH98	2100	196 - 216 l/min (51.8 - 57.1 USgpm)	17.5 l/min (4.6 USgpm)
PVH98QI	1800	167.5 - 186.4 l/min (44.2 - 49.2 USgpm)	17.5 l/min (4.6 USgpm)
PVH131	2000	249 - 275 l/min (65.8 - 72.6 USgpm)	22 l/min (5.8 USgpm)
PVH131QI	1500	187 - 207 l/min (49.4 - 54.7 USgpm)	22 l/min (5.8 USgpm)

Table 5: Flow Specifications

CV Control calibration, stability & internal check valve test.

Note

To adjust the "CV" control, perform steps 1 through 7. Refer to Figures 13 and 30 during the adjustment procedure. Turn the adjusting screws clockwise to increase pressure and counterclockwise to decrease pressure.

1. Perform the preliminary set–up procedure.

2. Set the pump to rated rpm as shown in Table 6.

3. Adjust valve A to obtain 250 bar (3625 psig) at P2.

4. Adjust valve B to obtain an outlet flow that is specified in Table 6.

5. Turn load sensing screw (15) until 20 (±1 bar) (290 ±14.5 psid) pressure differential is obtained between P2 and P1. Tighten nut (14).

6. Open valve B and adjust valve A to obtain 250 bar (3625 psig) at P2.

7. Turn pressure compensator screw (4) until pressure at P2 starts to decay below 3626 psi. Adjust screw (4) to a desired pressure level. If a pressure level is not specified, adjust the screw to 250 bar (3625 psi).

Pump Model	Rated Speed (rpm)	Pump Outlet Flow for Setting ΔP
PVH57	2400	70 l/min (18.5 USgpm)
PVH57QI	1800	50 l/min (13.2 USgpm)
PVH74	2200	80 l/min (21.0 USgpm)
PVH74QI	2100	75 l/min (19.8 USgpm)
PVH74QI	1800	65 l/min (17.2 USgpm)
PVH98	2100	105 l/min (27.7 USgpm)
PVH98QI	1800	90 l/min (23.8 USgpm)
PVH131	2000	130 l/min (34.0 USgpm)
PVH131QI	1500	144 l/min (38.0 USgpm)

Table 6: Outlet Flow Setting

Note

Refer to Figure 30 during the following procedure.

1. Adjust valve A to 28 bar (400 psig) outlet pressure at P2. Operate the pump at a rated speed (rpm) as stated in Table 4.

2. Close valve A rapidly. There should be no indication of pump instability. (Note: Pump instability is when outlet pressure oscillations exceed ±3.5 bar (50 psi) around control pressure setting of 250 bar (3625 psi). When valve A is closed, the pressure at P2 should be within ±4.0 bar (58 psi) of the initial pressure setting.

3. Close needle valve V. The differential pressure between P3 and P4 must be 0.9-1.7 bar (13–25 psid). Open needle valve V.

Unloading Valve: (refer to Figure 31)

NOTE

Testing for a pump with unloading valve requires an external pressure source of 207 bar (3000 psi).

1. Install unit in the test circuit and fill pump case.

2. Fully open load valve A.

3. Operate unit at rated speed as specified in Table 5 and adjust outlet pressure to 28 bar (400 psi) until all air is removed from the circuit.

4. Increase unit outlet pressure P1 to 150 bar (2175 psi) by adjusting valve A and hold for 1 minute followed by 15 seconds at 28 bar (400 psi). Increase the outlet pressure to 250 bar (3625 psi) for 1 minute. Unit must be able to meet flow and flow loss requirements as specified in Table 5 at both conditions.

Pressure limiting and case-to-inlet check valve calibration

1. With valve A closed, adjust the pressure limiting setting (P1) to the pressure specified by model code ±4.0 bar (58 psi).

2. With pump at rated speed, maximum flow, and outlet pressure (P1) of 28 bar (400 psi), close valve A rapidly. There should be no indication of yoke hunting or pump instability. Instability is evidenced by sustained pump outlet pressure oscillations greater than ±3.5 bar (50 psi) about nominal pressure limiting setting. With valve A closed, the pressure should be within ±4.0 bar (58 psi) if initial setting in paragraph 1.

3. Operate pump at rated speed with valve A closed and unit operating at pressure limiter setting. Block off case drain flow by closing valve C. The case pressure should be maintained at 0.9-1.7 bar (13-25 psi) above inlet pressure.

Unloading valve standby pressure & leakage

1. Apply 207 ±2 bar (3000 ±30 psi) from external supply to the accumulator port of unloading valve (Pe). Close valve A and adjust the load sensing screw on the control so the pump operates at zero flow and at the outlet pressure (P1) as listed in Table 7:

Unit	Model Code Suffix	Outlet Pressure P1
PVH74	083	440 ±15 psi
PVH131	072	440 ±15 psi
PVH131	077	440 ±15 psi

Table 7

2. Plug all ports and apply air to case at a pressure of 3.5 bar (50 psi) while unit is immersed in a non-corrosive fluid. No external leakage is permitted.

Alternate testing method, if no external pressure source is available:

1. Assemble pump without unloading valve and tubing attached but with CV control attached directly to the valve block. Complete test steps for the CV control.

2. Shut off test stand and assemble unloading valve and tubing onto the pump.

3. Install pump onto stand and run at rated speed and at 35 bar (500 psi) below compensator setting. Testing is complete if no oil leaks are observed.

4. Plug all ports and apply air to case at a pressure of 3.5 bar (50 psi) while unit is immersed in a non-corrosive fluid. No external leakage is permitted.

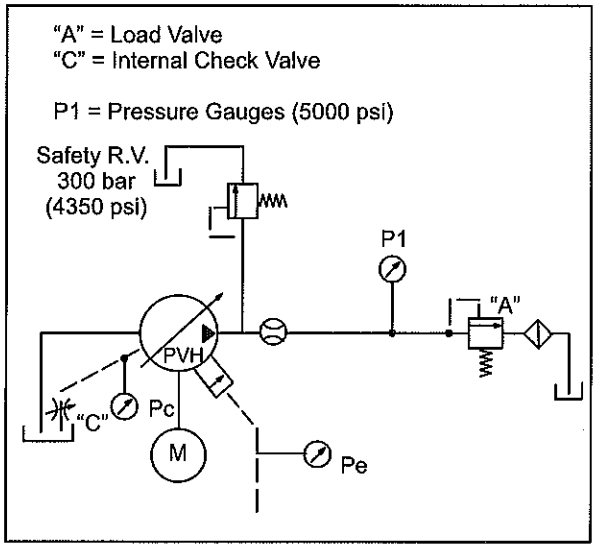


Figure 31: Unloading Test Circuit

Industrial Control: (refer to Figure 32)
PVH**QI

1. Install unit in the test circuit and fill pump case.

2. Fully open load valve A, throttle valves B and C, while keeping throttle valve D closed.

3. Operate unit at rated speed as specified in Table 5 and adjust outlet pressure using load valve A to 28 bar (400 psi) until all air is removed from the circuit.

4. Using load valve A, increase unit outlet pressure to 150 bar (2175 psi) and hold for 1 minute followed by 15 seconds at 28 bar (400 psi). Increase the outlet pressure to 250 bar (3625 psi) for 1 minute. Unit must be able to meet flow and flow loss requirements as specified in Table 5 at both conditions unless the pump is at reduced stroke.

Industrial Control valve calibration and testing

1. Adjust industrial control valve to obtain a pressure differential P2-P1 per chart below when throttle valve B is adjusted to obtain pump outlet flow as specified in Table 6 and with P2 at 150 bar (2175 psi). Change in differential pressure P2-P1 cannot exceed 5.0 bar (72.5 psi) when pressure P1 is varied between 150 bar (2175 psi) and 220 bar (3190 psi). The control is now set.

2. Fully open throttle valve B. Vary pump outlet flow from maximum flow (Table 5) to 7.5 l/min (2.0 USgpm) flow by closing valve B. The change in pressure differential between 90% maximum flow and 10% minimum flow should be within limits specified in Table 8, about nominal setting.

3. Cycle the pump outlet flow from maximum to minimum flow with throttle valve B. Pump outlet pressure must be stable. With valve B closed and P1 at zero pressure, the outlet pressure must not increase over the setting in Table 8 by more than the value in Table 5.

4. With throttle valve B open and load valve A set for 150 bar (2175 psi), open throttle valve D. Pump will go to zero flow. The outlet pressure must be less than setting in Table 8 plus maximum increase defined in Table 5. (This is done to assure that the orifice is assembled into the control. If it is not, flow through throttle valve D will be high.)

The industrial control pressure differential is incorporated in the model code. The value is listed immediately after the IC in the model code. When no value is present in the model code, the pressure differential is 20 bar (290 psi). The tolerance for all settings is ± 1.0 bar (± 14.5 psi).

Unit	Pressure Differential (P2-P1) @ Specified Flow
PVH*QI**IC	20.0 ± 1.0 bar (290.0 ± 15.5 psi)
PVH*QI**IC17	17.0 ± 1.0 bar (247.0 ± 14.5 psi)
PVH*QI**IC35	35.0 ± 1.0 bar (508.0 ± 14.5 psi)

Table 8

Inlet check valve testing

1. With pump at rated speed, valve A set for pump outlet pressure of 250 bar (3625 psi), throttle valve B open, and throttle valve D closed, close throttle valve C. Case to inlet pressure differential must be 0.9-1.7 bar (13-25 psi).

Plug all ports and apply air to case at a pressure of 3.5 bar (50 psi) while unit is immersed in a non-corrosive fluid. No external leakage is permitted.

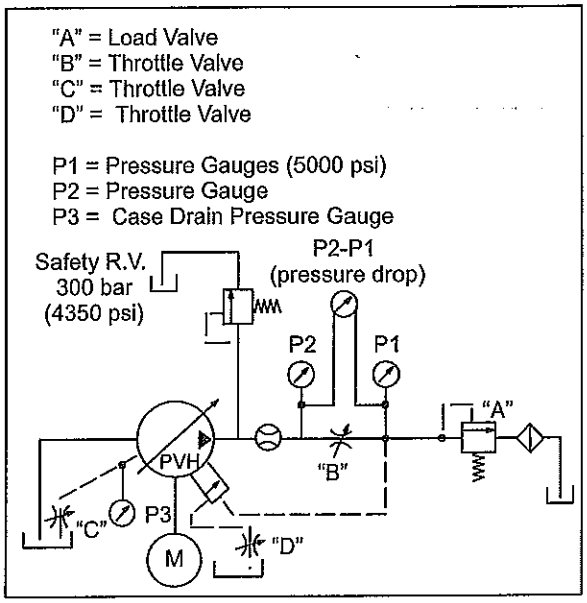


Figure 32: Industrial Control Test Circuit

Load Sensing, Torque Limit and Pressure Limit Controls
(refer to Figure 33)

1. Install unit in the test circuit and fill pump case.

2. Fully open load valve A and throttle valve B.

3. Operate unit at rated speed as specified in Table 5 and adjust outlet pressure to 28 bar (400 psi) until all air is removed from the circuit.

4. Increase unit outlet pressure to 150 bar (2175 psi) and hold for 1 minute followed by 15 seconds at 28 bar (400 psi). Increase the outlet pressure to 250 bar (3625 psi) for 1 minute. The pump must be able to meet flow and flow loss requirements as specified in Table 5 at both conditions unless unit is at reduced stroke.

Load Sensing valve calibration and testing

1. Adjust load sensing valve to obtain a pressure differential P2-P1 per Table 9 when throttle valve B is adjusted to obtain pump outlet flow as specified in Table 6 and with P2 at 150 bar (2175 psi). Change in differential pressure P2-P1 cannot exceed 5.0 bar (72.5 psi) when pressure P1 is varied between 150 bar (2175 psi) and 220 bar (3190 psi). The load sensing valve is now set.

2. Fully open throttle valve B. Vary pump outlet flow from maximum flow (Table 5) to 7.5 l/min (2.0 USgpm) flow by closing valve B. The change in pressure differential between 90% maximum flow and 10% minimum flow should be within limits specified in Table 9 about nominal setting.

3. Cycle the pump outlet flow from maximum to minimum pump flow with throttle valve B closed and P1 at zero pressure, the outlet pressure must not increase over the setting in Table 9 by more than the value in Table 6.

Load sensing differential pressure is incorporated in the model code. The value is listed immediately after the "V" in the model code. Pressure is in bar. Tolerance is as listed. When no value is present in the model code, 20 bar (290 psi) is to be used.

Unit	Pressure Differential (P2-P1) @ Specified Flow
C**V17	17.0 ±1.0 bar (247.0 ±14.5 psi)
C**V21	21.0 ±1.0 bar (305.0 ±14.5 psi)

Table 9

Setting Torque Limit Feedback Control (CT)

Remove plug (1, Figure 29) from valve block and install a pressure gauge. Operate the pump at rated rpm as specified in Table 5 and increase outlet pressure to 140 bar (2000 psi). The differential pressure between outlet pressure and feedback pressure should be 14.5 bar (210 ±10 psi). Adjust with shims (60, Figure 29) under the head of the feedback sleeve (66, Figure 29) to suit. Pressure differential will change approximately .1 bar (1.5 psi) per .001" of shim.

Setting Torque Limiter

Operate pump at rated speed. Slowly close valve A until the outlet pressure P1 is the nominal model setting ±1.5%. Back out slowly the torque limiting screw (7d, Figure 16) CCW until a drop in flow is noted. Check this setting by opening valve A until pressure drops 34.5 bar (500 psi). Slowly close valve A until the pump destrokes. This will be noted by a sharp reduction of output flow.

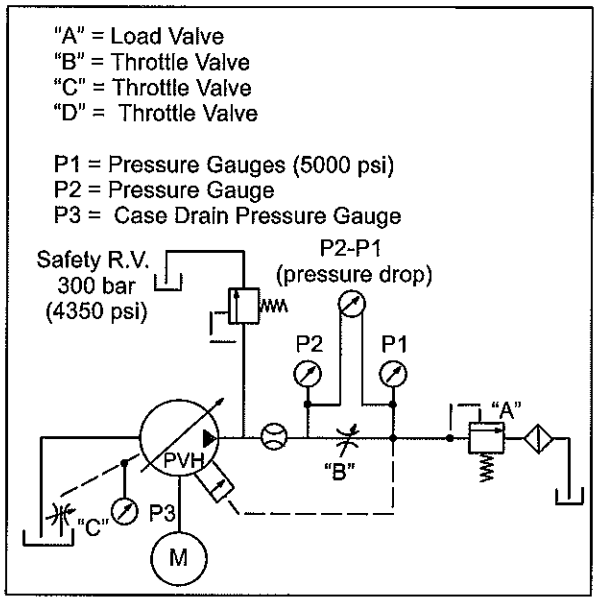


Figure 33: Load Sensing, Torque/Pressure Limit Test Circuit

Setting Pressure Limiter

1. Back out pressure limiter screw (26d, Figure 16) 4.5 turns CCW. With the pump operating at rated speed, close valve A. Raise pressure limiter setting by adjusting pressure limiter screw (26d, Figure 16) CW until the nominal specified model setting is reached ±1.7%. Pressure will change about 2.7 bar (40 psi) for each 10° of rotation.

2. After pressure limiter is set, recheck that the torque limiter set point occurs at specified setting ±5% when the pump begins to destroke (significant reduced output flow). Readjust torque limiting screw (7d, Figure 16) if necessary.

Stability Test

With pump at rated speed, maximum flow, and outlet pressure of 28 bar (400 psi), close load valve A rapidly. There should be no indication of yoke hunting or pump instability. Instability is evidenced by sustained pump outlet pressure oscillations greater than ±3.5 bar (50 psi) about nominal pressure limiting setting. With valve A closed, the pressure should be within ±4.0 bar (58 psi) of initial setting.

Internal case relief valve functional test

1. Operate pump at rated speed with valve A closed and pump operating at pressure limiter setting. Block off case drain flow by closing valve C. The case pressure should be at 0.9-1.7 bar (13-15 psi) above inlet pressure.

2. Plug all ports and apply air to case at a pressure of 3.5 bar (50 psi) while unit is immersed in a non-corrosive fluid. No external leakage is permitted.

D. Start–up Procedure

Make sure the reservoir and circuit are clean and free of dirt/debris prior to filling with hydraulic fluid.

Fill the reservoir with filtered oil to a level sufficient to prevent vortexing at suction connection to pump inlet. It is good practice to clean the system by flushing and filtering using an external slave pump.

Before starting the pump, fill with fluid through one of the ports. This is particularly important if the pump is above the fluid level of the reservoir.

When initially starting the pump, remove all trapped air from the system. This can be accomplished by loosening the pump outlet fittings or connections before starting the pump or by using an air bleed valve. All inlet connections must be tight to prevent air leaks.

Once the pump is started it should prime within a few seconds. If the pump does not prime, check to make sure that there are no restrictions between the reservoir and the inlet to the pump, and there are no air leaks in the inlet line and connections. Also check to make sure that trapped air can escape at the pump outlet.

After the pump is primed, tighten the loose outlet connections, then operate for five to ten minutes (unloaded) to remove all trapped air from the circuit.

If reservoir has a sight gage, make sure the fluid is clear -- not milky.

Add fluid to the reservoir up to the proper fill level.

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EATON | Vickers

H Series Vickers Piston Pumps
Pressure & Flow Compensator Kit
Installation Information

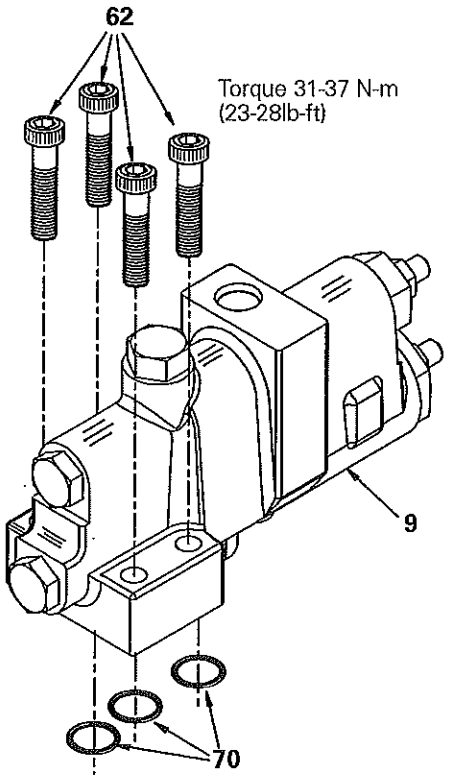
PVH057 / 63
PVH074 / 81
PVH098 / 106
PVH131 / 141

For more detailed information contact EATON Hydraulics at one of the addresses listed below.

Please reference the following documents:

- For Specifications and Performance Data see Catalog No. GB-C-2010.
- For parts Information for the PVH Piston Pump refer to Service Data below.
- When servicing PVH Piston Pump Compensators refer to these Service Data documents:

PVH057 / 063	M-2206-S
PVH074 / 081	M-2207-S
PVH098 / 106	M-2208-S
PVH131 / 141	M-2209-S



Pressure & Flow Compensator Parts

Model Code Feature (postion 14) = B, E, M, N

ITEM	DESCRIPTION	QTY
9	Pressure & Flow Compensator	1
62	Cap Screw	4
70	O-ring	3

⚠ WARNING

EATON recommends for positive displacement pumps that a relief valve be fitted between the pump and the load to protect against overload of the pump or system.

WARNING: NEVER ADJUST THE COMPENSATOR TO ALLOW THE PUMP OR THE HYDRAULIC SYSTEM TO EXCEED THEIR MAXIMUM RATED PRESSURES. REFER TO THE OPERATORS MANUAL FOR MAXIMUM PRESSURES OR CONTACT THE SUPPLIER.

EXCESSIVE PRESSURE MAY RESULT IN ABRUPT AND VERY SERIOUS FAILURES IN THE SYSTEM WHICH CAN CAUSE DEATH OR SERIOUS BODILY INJURY TO PERSONS NEARBY AND/OR DAMAGE THE PUMP.

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Printed in USA
Document No. V-PUPI-TI005-E
May 2004

 Vickers main pump controler

Load Sensing and Pressure Compensator Control – Code B or C

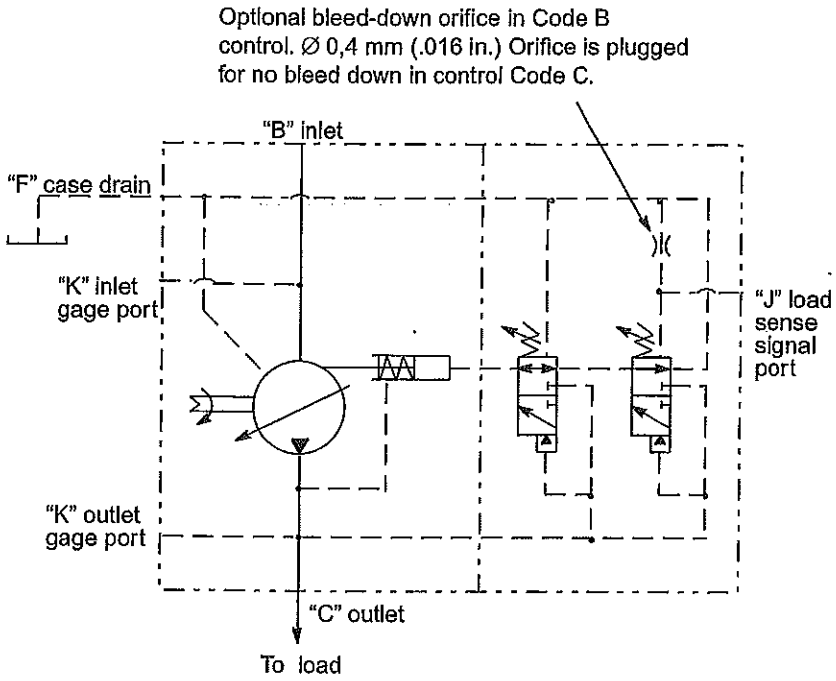
The pump will provide power matching of pump output to system load demand, maximizing efficiency and improving load metering characteristics of any directional control valve installed between the pump and the load.

Load sensing ensures that the pump always provides only the amount of flow needed by the load. At the same time, the pump operating pressure adjusts to the actual load pressure plus a pressure differential required for the control action. When the system is not demanding power, the load sense control will operate in an energy-saving stand-by mode.

Typically, the differential pressure is that between the pressure inlet and service port of a proportionally controlled directional valve, or a load sensing directional control valve. See the model code on page 4 for differential pressure settings for load sensing.

If the load pressure exceeds the system pressure setting, the pressure compensator destrokes the pump. The load sensing line must be as short as possible and can also be used for remote control or unloading of the pump pressure. For remote control purposes, it is recommended that you contact your Eaton representative for the correct configuration of the control.

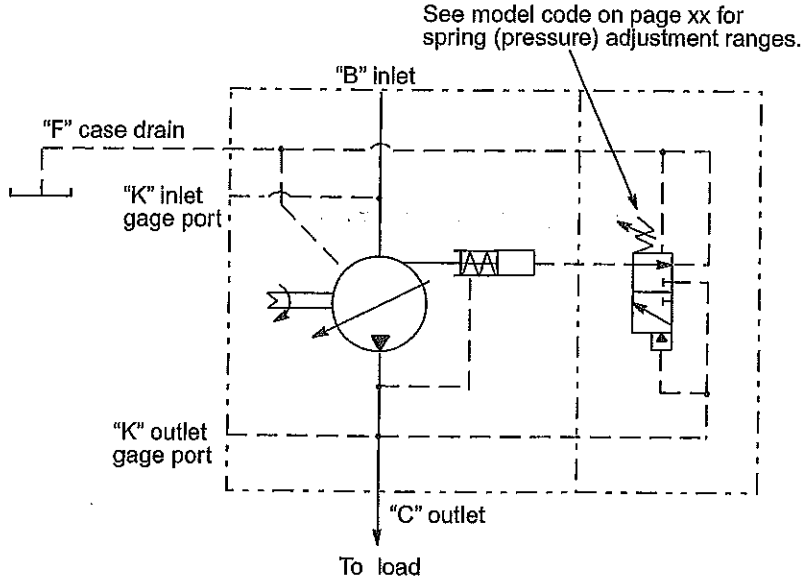
Warning: The pressure compensator may be adjusted beyond the rated pressure of the pump. When adjusting the pressure limiter, install a 0-350 bar (0-5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement shown on page 7.



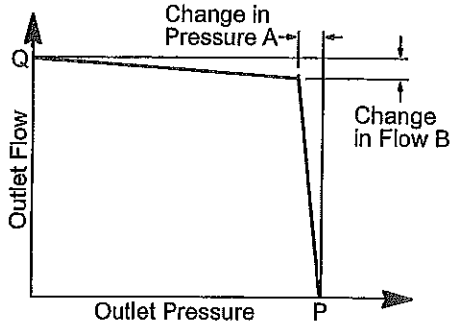
Pressure Compensator Control – Code A

The pump will provide a continuously modulated flow to meet changing load demands at a pre-adjusted compensator pressure. At pressures below the compensator setting, the pump will operate at maximum displacement. See model code on page 4 for compensator pressure ranges.

Warning: The pressure compensator may be adjusted beyond the rated pressure of the pump. When adjusting the pressure limiter, install a 0-350 bar (0-5000 psi) gage in the outlet gage port and limit the pressure setting to the continuous rated pressure for the pump displacement shown on page 7.



Pressure Cut-off Characteristics of Code A Pressure Compensator Control at 50°C (120°F), static conditions.



PRESSURE CUT-OFF CHARACTERISTICS OF PRESSURE COMPENSATOR CONTROL @ 50°C (120°F), STATIC CONDITIONS

Model Series	Max. Speed r/min	"Q" Outlet Flow l/min (USgpm)	"P" Outlet Pressure bar (psi)	A bar (psi)	B L/min (USgpm)
PVM018	1800	32 (8.5)	280 (4000)	2,8 (40)	4,5 (1.2)
PVM020	1800	35 (9.25)	230 (3300)	2,8 (40)	4,5 (1.2)
PVM045	1800	76 (20)	280 (4000)	10 (150)	4,5 (1.2)
PVM050	1800	87 (23)	230 (3300)	10 (150)	4,5 (1.2)
PVM057	1800	102 (27)	280 (4000)	3,5 (51)	14 (3.7)
PVM063	1800	113 (29)	230 (3300)	7,4 (107)	7,6 (2.00)
PVM074	1800	127 (33.5)	280 (4000)	1,5 (22)	37 (9.8)
PVM081	1800	141 (37)	230 (3300)	1,5 (22)	37 (9.8)
PVM098	1800	179 (47)	280 (4000)	1,5 (22)	25 (6.6)
PVM106	1800	195 (51.5)	230 (3300)	1,5 (22)	20 (5.3)
PVM131	1800	229 (60.5)	280 (4000)	3,5 (51)	19 (5.0)
PVM141	1800	238 (63)	230 (3300)	3,5 (51)	14 (3.70)

Model Code

Industrial pumps

PVH *** QI * – * (*) * – ** * – 10 – C(M) ** (**) (**) – *0 – ***

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

Mobile pumps

PVH *** – C – * (*) * – ** * – 10 – C ** (**) (**) – *0 – ***

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

1 Piston pump, variable displacement

2 Maximum geometric displacement

57 = 57.4 cm^3/r (3.5 in^3/r)
74 = 73.7 cm^3/r (4.5 in^3/r)
98 = 98.3 cm^3/r (6.0 in^3/r)
131 = 131.1 cm^3/r (8.0 in^3/r)

3 Industrial version

4 Mounting flange, prime mover end

C = SAE "C" 4–bolt type (SAE J744-127-4)
M = ISO 3019/2–125B4HW (Option for PVH57QI and PVH/74QI only)

5 Shaft rotation, viewed at prime mover end

R = Right hand, clockwise (Standard on QI models)
L = Left hand, counterclockwise (Optional on QI models)

6 Configuration

Blank = Non-thru-drive (single pump)
A = Thru-drive pump with SAE "A" 2-bolt rear flange mounting (SAE J744-82-2)
B = Thru- drive pump with SAE "B" 2- and 4-bolt rear flange mountings♦ (SAE J744-101-2/4)
C = Thru-drive pump with SAE "C" 2- and 4-bolt rear flange mountings♦ (SAE J744-127-2/4)
S = Adjustable maximum volume stop (non-thru-drive and non-torque-control pumps only)

7 Main ports

F = SAE 4-bolt flange pads (standard)
M = SAE 4-bolt pads with metric mounting bolt threads (PVH57 & PVH74 only)

8 Shaft-end type, at prime mover end

N =	ISO 3014/2-E32N	Short straight keyed
1 =	SAE "C" (J744-32-1)	Straight keyed
2 =	SAE "C"■ (J744-32-4)	Splined 14 tooth 12/24 D.P.
3 =	SAE "CC" (J744-38-4)	Splined 17 tooth 12/24 D.P.
12 =	SAE "D" (J744-44-4)	Splined 13 tooth 8/16 D.P.
13 =	SAE "C (J744-38-1)	Straight keyed
16 =	SAE "D" (J744-44-1)	Straight keyed

9 Shaft seal, prime mover end

S = Single, one-way (standard)
D = Double, two-way (optional) Recommended on second pump of tandem assembly (PVH**/ PVH**)

10 Pump design number

10 (Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.)

11 Pressure compensator adjustment range

C = 70-250 bar (1015-3625 psi) (standard)
CM = 40-130 bar ((580-1885 psi) (optional QI version)
IC = Industrial control
UV = Unloading valve control for accumulator circuits

♦ Built from pump with SAE "A" rear pad to which suitable flange adapter is bolted. For best availability and flexibility, order PVH SAE "A" thru-drive pump and SAE "B" or "C" adapter kit separately.

12 Pressure compensator factory setting in tens of bar

25 = Normal factory setting of 250 bar for "C" models.
7 = Normal factory setting of 70 bar for "CM" models.

13 Additional control functions

Blank = No additional controls
V = Load sensing, 20 bar differential pressure setting
T = Torque limiter
VT = Load sensing and torque limiter

14 Torque limiter factory setting

** = Customer desired torque limiter setting specified in ten bar (145 psi) increments, e.g.:
8 = 80 bar (1160 psi);
18 = 180 bar (2610 psi).
The torque setting range is from 30–80% of the specified compensator setting.

15 Control design number

31 = C, CM, or C**V controls.
13 = C**T controls
14 = C**VT controls
10 = UV and IC controls

16 Special features suffix

027= Composite 2-bolt/4-bolt mounting conforming to SAE "C" (except PVH131)
031= Thru-drive SAE "A" pad cover
041= No case-to-inlet relief (for use with supercharged circuits)
057= Shaft-up operation (vertical mount)

■ Torque restrictions apply to #2 shaft in PVH74 and 98 thru-drive, and PVH131 single and thru-drive, pumps. Vickers is not responsible for misapplied usage of these shafts. Please contact a Vickers representative for review of your application.

10,000 Series Two-Speed

Dimensions

Ports

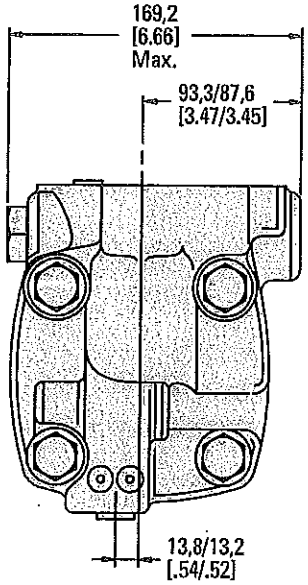
1 5/16 -12 UN-2B SAE O-ring Staggered Ports (2)
3/4 -16 UNF-2B SAE O-ring Case Drain Port (1)
7/16 -20 UNF-2B SAE O-ring Pilot Control Port (1) or

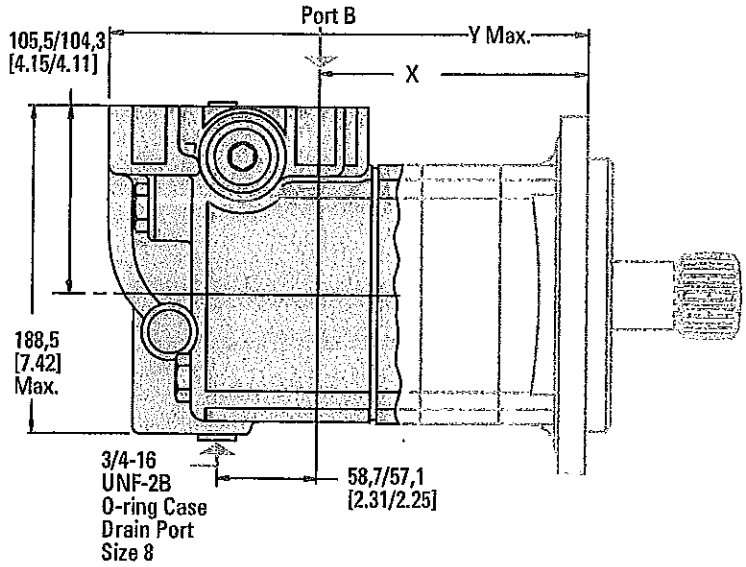
4 bolt 1 1/4 inch Split Flange Ports (2)
3/4 -16 UNF-2B SAE O-ring Case Drain Port (1)
7/16 -20 UNF-2B SAE O-ring Pilot Control Port (1)

Standard Rotation Viewed from Shaft End

Port A Pressurized — CW
Port B Pressurized — CCW

Bearingless





BEARINGLESS MOTOR DIMENSIONS

Displacement cm^3/r [in^3/r]	X mm [inch]	Y mm [inch]
345 [21.0]	146,3 [5.76]	268,2 [10.56]
480 [29.2]	159,0 [6.26]	280,9 [11.06]
665 [40.6]	159,0 [6.26]	280,9 [11.06]
940 [57.4]	177,3 [6.98]	299,5 [11.79]

10,000 Series Two-Speed

Product Numbers

Note:

For 10,000 Series Motors with a configuration **Not Shown** in the chart below: Use model code number system on the page C-5-13 to specify product in detail.

Use digit prefix — 119-, 120-, or 121 - plus four digit number from charts for complete product number— Example 121-2002.

Orders will not be accepted without three digit prefix.

MOUNTING	SHAFT	PORT SIZE	DISPL. cm^3/r [in^3/r] / PRODUCT NUMBER			
			345 [21.0]	480 [29.3]	665 [40.6]	940 [57.4]
Standard	2 1/4 Inch Straight	1 5/16 O-ring	119-2013	-2014	-2015	-2016
		1 1/4 inch Split Flange	119-2001	-2002	-2003	-2004
	2 1/8 Inch 16 T Splined	1 5/16 O-ring	119-2021	-2022	-2023	-2024
		1 1/4 inch Split Flange	119-2009	-2010	-2011	-2012
	2 1/4 Inch Tapered	1 5/16 O-ring	119-2017	-2018	-2019	-2020
		1 1/4 inch Split Flange	119-2005	-2006	-2007	-2008
Wheel Motor	2 1/4 Inch Straight	1 1/4 inch Split Flange	120-2005	-2006	-2007	-2008
	2 1/8 Inch 16 T Splined	1 1/4 inch Split Flange	120-2009	-2010	-2011	-2012
	2 1/4 Inch Tapered	1 5/16 O-ring	120-2013	-2014	-2015	-2016
		1 1/4 inch Split Flange	120-2001	-2002	-2003	-2004
Bearingless		1 5/16 O-ring	121-2005	-2006	-2007	-2008
		1 1/4 inch Split Flange	121-2001	-2002	-2003	-2004

121-2002

10,000 Series Two-Speed

Description

Drill motor
Char-Lynn

The Eaton 10,000 Series motors are available with an integral two speed feature that changes the displacement in a ratio of 1 to 2 and shifts the motor from a low speed high torque (LSHT) mode to a high speed low torque (HSLT) mode. The open center selector valve shifts the speed mode from low to high speed when pilot pressure of 6.9 Δ Bar [100 Δ PSI] minimum is applied to the pilot port (6.9 Bar [100 PSI] higher than case pressure). In the high speed mode torque values are approximately one half with twice the speed of the conventional 10,000 Series single speed motors.

An external two position three way valve is required for shifting the pilot pressure port between signal pressure (HSLT) and low pressure (LSHT)

Two speed motors are available with a return line closed center shuttle for closed circuit applications.

Low speed high torque mode is the normal position of the speed selector valve. When a differential pressure is supplied to the pilot port and 6,9 Bar [100 PSI] is reached, the selector valve overcomes the return spring force and the spool shifts to the high speed mode. The oil in the opposite side of the spool is drained internally. Pressure between the pilot supply and case drain or return line (depending on open or closed circuit system) must be maintained to keep the motor in the high speed mode.

When pilot pressure is removed from the pilot port the pressure in the pilot end of the spool valve is relieved and drained back through this three way valve, the spring force returns the spool valve to LSHT position.

Pilot pressure may come from any source that will provide uninterrupted pressure during the high speed mode operation. Pilot pressure 6,9 Δ Bar [100 Δ PSI] minimum, up to the full operating pressure of the motor.

In normal LSHT operation the Char-Lynn two speed motor will function with equal shaft output in either direction (CW or CCW), the same as the single speed Char-Lynn disc valve motors.

However, to prevent cavitation in the HSLT mode, the preferred direction of shaft rotation is counter clockwise (port B pressurized). This unique disc valve is not symmetrical in porting the fluid for the HSLT mode. Consequently, when the pressure is reversed for HSLT CW rotation, cavitation can occur. Installing a restriction (200 PSI or more depending on flow) in the hydraulic line that connects port B will prevent cavitation.

If you are operating in a critical area and a restriction in the hydraulic line causes concern, these two speed motors can be ordered timed with CW preferred HSLT shaft rotation. Hence, with this option port B will have to be pressurized for CW preferred HSLT shaft rotation. The restriction recommended for the line connecting port B remains unchanged. Finally in closed circuit applications a hydraulic line restriction is not required. Instead, the charge pump can be used to supply and maintain a minimum pressure of 14 Bar [200 PSI].

Note:

Be certain in closed loop applications that the charge pump when used for back pressure on the B port, has sufficient displacement to maintain charge pressure especially in dynamic braking or overrunning load conditions.

Important!

Due to potential problems in maintaining charge pump pressure at port B for uninterrupted back pressure during dynamic braking, Eaton does not recommend the two speed motor where overrunning conditions may exist.

Performance Data

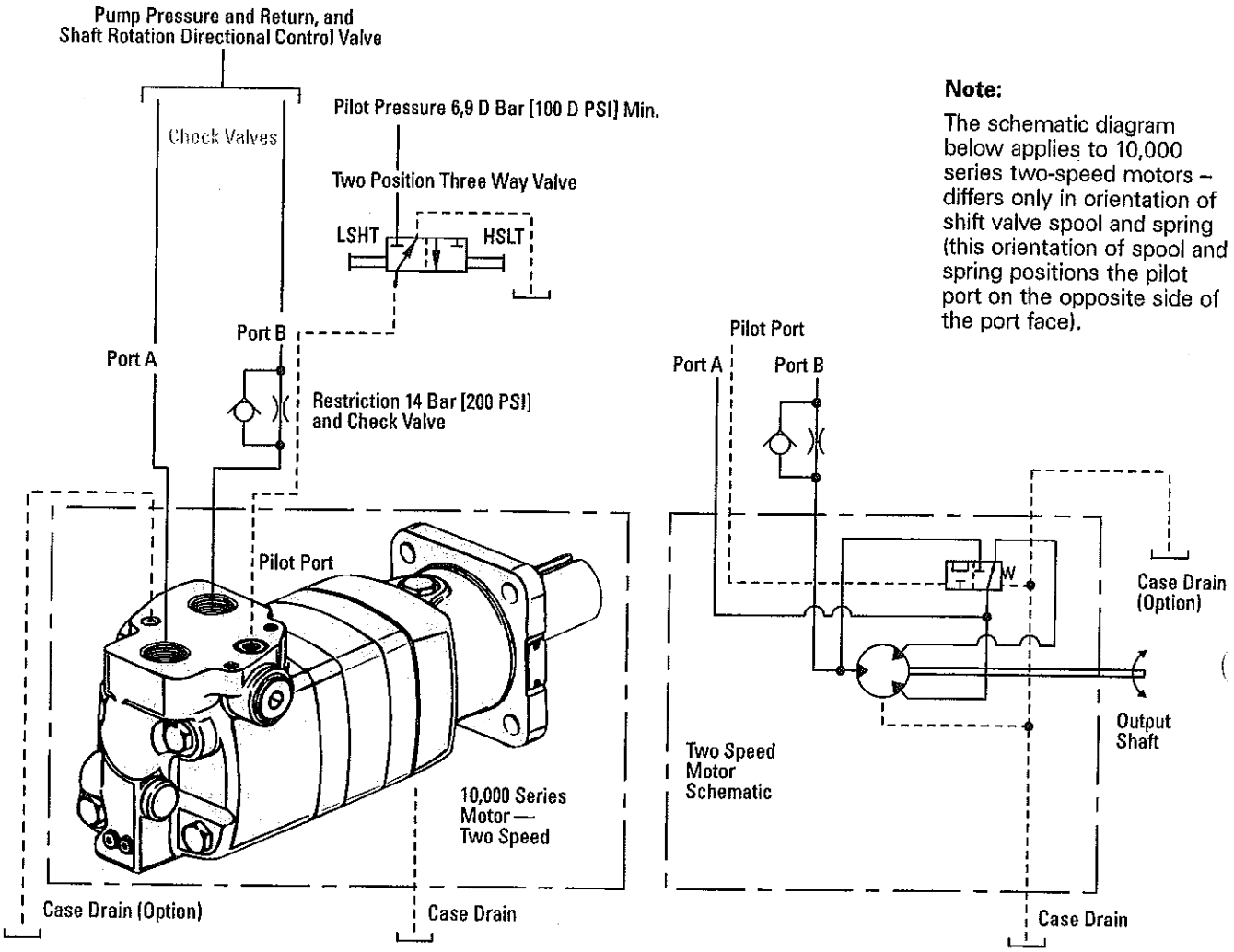
10,000 Series Two-Speed

In the high speed mode torque values are approximately one half with twice the speed of the conventional 10,000 Series single speed motors.

In the low speed mode torque and speed values are the same as the conventional 10,000 series single speed motors.

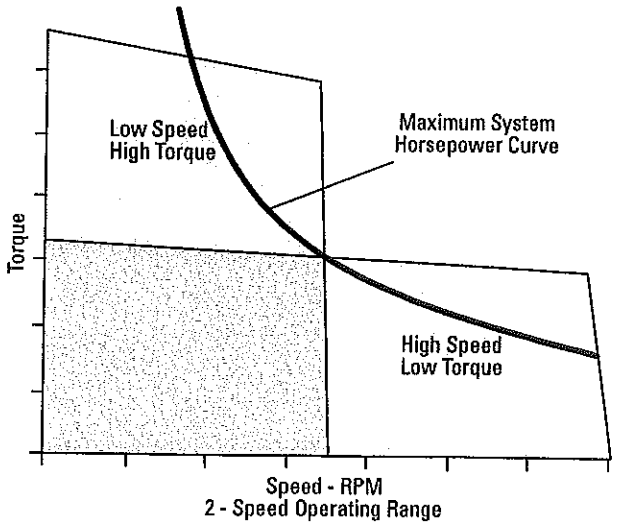
10,000 Series Two-Speed

Typical Hydraulic Circuit



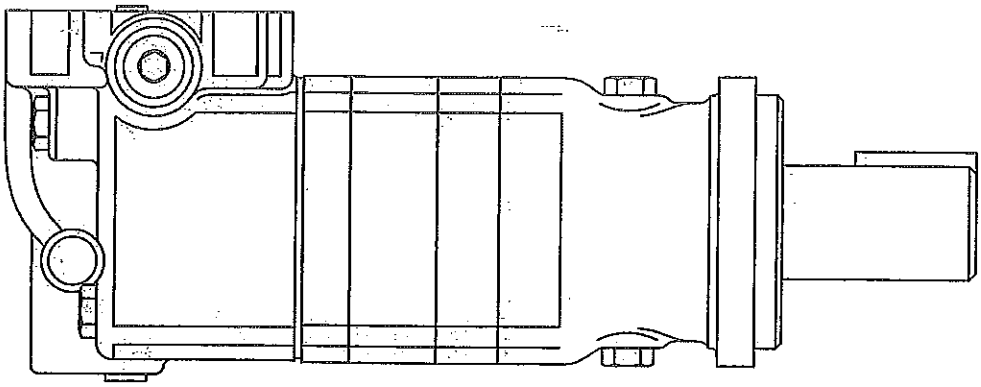
Note:

The schematic diagram below applies to 10,000 series two-speed motors – differs only in orientation of shift valve spool and spring (this orientation of spool and spring positions the pilot port on the opposite side of the port face).



10,000 Series Two-Speed

Specifications



10,000 SERIES TWO-SPEED MOTORS

Displ. cm³/r [in³/r]	High Speed Mode	169[10.3]	239 [14.6]	332,7 [20.3]	470 [28.7]
	Low Speed Mode	345 [21.0]	480 [29.3]	665 [40.6]	940 [57.4]
Max. Speed (RPM)	High Speed Mode	750	630	500	400
@ Continuous Flow	Low Speed Mode	375	315	250	200
Flow	High Speed Mode	130 [35]	170 [45]	170 [45]	170 [45]
l/min [GPM]	Low Speed Mode	130 [35]	170 [45]	170 [45]	170 [45]
Torque*	High Speed Mode				
Nm [lb-in]	Continuous	440 [3900]	630 [5600]	905 [8000]	1175 [10400]
	Intermittent	585 [5200]	845 [7500]	1130 [10000]	1470 [13000]
Torque*	Low Speed Mode				
Nm [lb-in]	Continuous	1015 [9000]	1470 [13000]	2090 [18500]	2710 [24000]
	Intermittent	1355 [12000]	1965 [17400]	2600 [23000]	3445 [30500]
Pressure	Continuous	205 [3000]	205 [3000]	205 [3000]	190 [2750]
Δ bar [Δ PSI]	Intermittent	275 [4000]	275 [4000]	260 [3750]	240 [3500]
Weight	Standard or Wheel Mount	50,3 [111.0]	52,2 [115.0]	52.2 [115.0]	54,0 [119.0]
kg [lb]	Bearingless	38,1 [84.0]	39,9 [88.0]	39,9 [88.0]	41,7 [92.0]

*See shaft torque ratings for limitations..

Note:

To assure best motor life, run motor for approximately one hour at 30% of rated pressure before application to full load. Be sure motor is filled with fluid prior to any load applications.

High Speed Mode

(Reduced Motor Displacement)

Low Speed Mode

(Full Motor Displacement)

Maximum Inlet Pressure:

275 bar [4000 PSI]

Do not exceed Δ pressure rating (see chart above).

Maximum Return Pressure:

275 bar [4000 PSI] with case drain line installed.

Do not exceed Δ pressure rating (see chart above).

Δ bar [Δ PSI] :

The true pressure difference between inlet port and outlet port

Continuous Rating:

Motor may be run continuously at these ratings

Intermittent Operation:

10% of every minute

Peak Operation:

1% of every minute

Recommended Fluids:

Premium quality, anti-wear type hydraulic oil with a viscosity of not less than 70 SUS at operating temperature.

Recommended Maximum System Operating Temp.:

82° C [180° F]

Recommended Filtration:

per ISO Cleanliness Code, 4406: 20/18/13

10,000 Series Two-Speed

Dimensions

Standard and Wheel

Ports

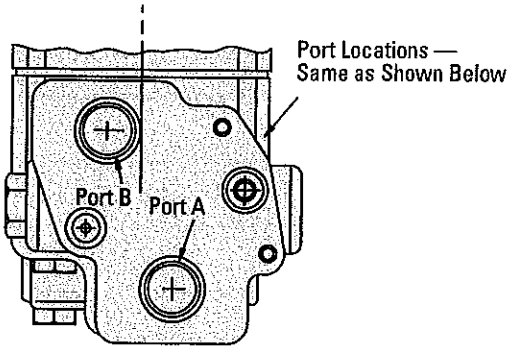
1 5/16 -12 UN-2B SAE O-ring Staggered Ports (2)
3/4 -16 UNF-2B SAE O-ring Case Drain Port (1)
7/16 -20 UNF-2B SAE O-ring Pilot Control Port (1) or

4 bolt 1 1/4 inch Split Flange Ports (2)
3/4 -16 UNF-2B SAE O-ring Case Drain Port (1)
7/16 -20 UNF-2B SAE O-ring Pilot Control Port (1)

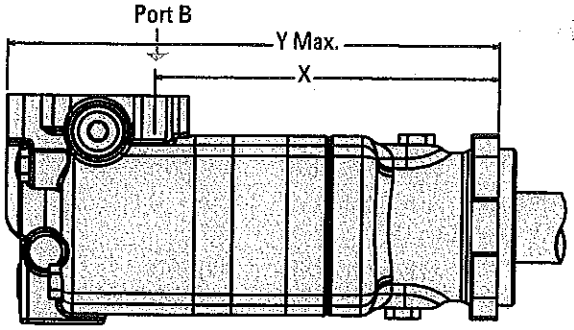
Standard Rotation Viewed from Shaft End

Port A Pressurized — CW
Port B Pressurized — CCW

1 5/16 -12 O-ring Staggered Ports



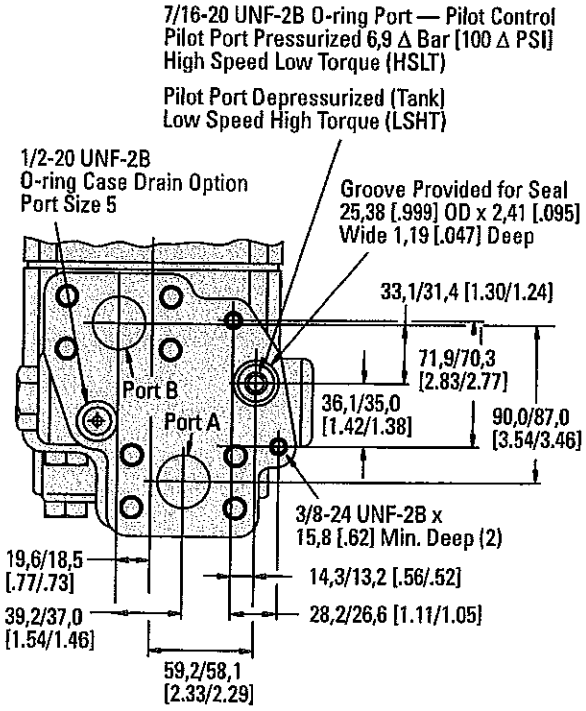
Two-Speed Standard Motors



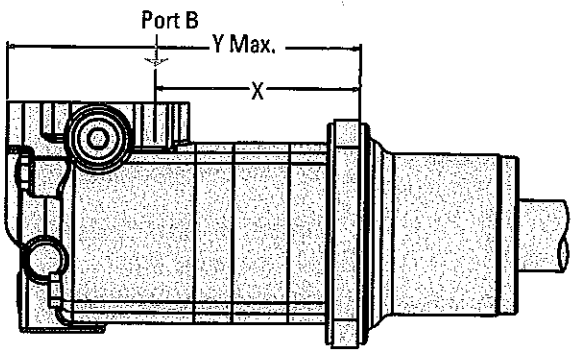
STANDARD MOUNT MOTOR DIMENSIONS

Displacement cm³/r [in³/r]	X mm [inch]	Y mm [inch]
345 [21.0]	270,8 [10.66]	392,7 [15.46]
480 [29.2]	283,5 [11.16]	405,4 [15.96]
665 [40.6]	283,5 [11.16]	405,4 [15.96]
940 [57.4]	301,8 [11.88]	423,7 [16.68]

4 Bolt 1 1/4 Inch Split Flange Ports



Two-Speed Wheel Motors



WHEEL MOUNT MOTOR DIMENSIONS

Displacement cm³/r [in³/r]	X mm [inch]	Y mm [inch]
345 [21.0]	155,2 [6.11]	277,9 [10.94]
480 [29.2]	167,9 [6.61]	290,6 [11.44]
665 [40.6]	167,9 [6.61]	290,6 [11.44]
940 [57.4]	186,2 [7.33]	309,1 [12.17]

Service Data

Vickers®

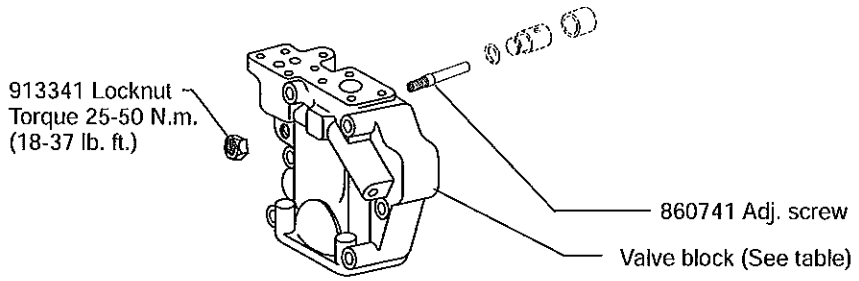
Piston Pumps

PVH74/81 Variable Displacement Piston Pump - 11 Design

Revised 11/01/97

M-2207-S

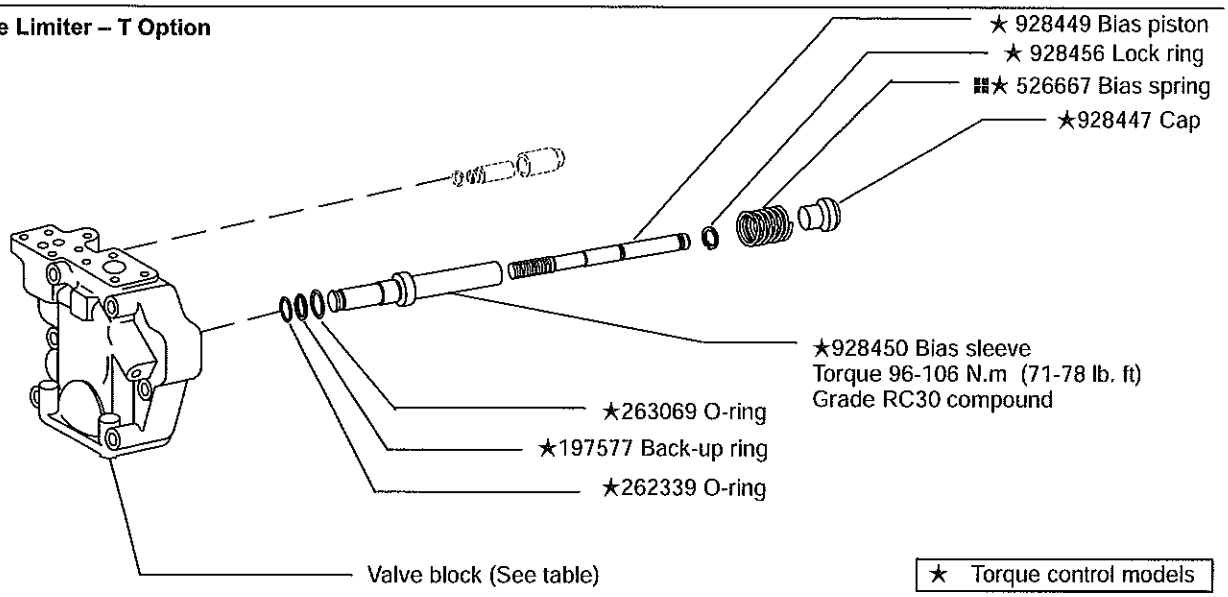
Maximum Adjustable Stop – S Option



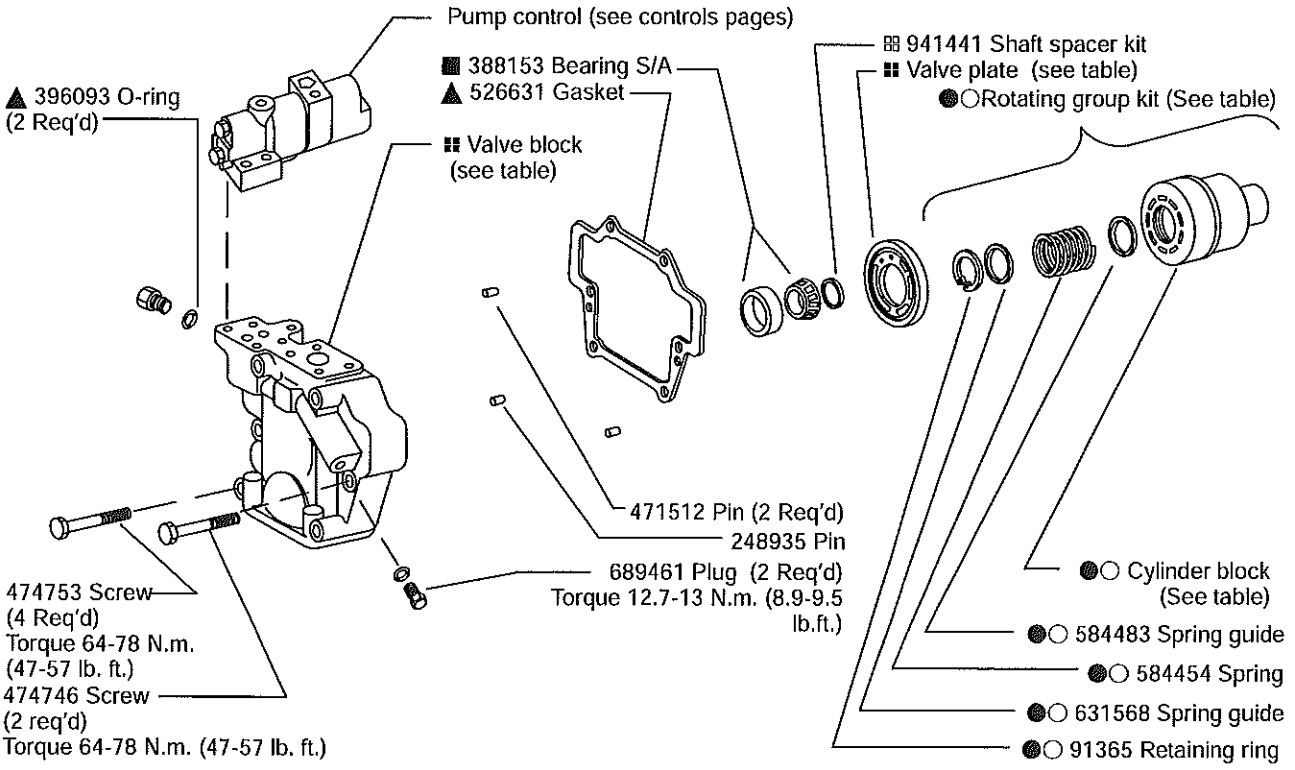
Valve Block Table

Pump Type	RH	LH
F–11–C	928633	928681
M–11–C	928634	928682
SF–11–C	928620	928669
SM–11–C	928621	928670
F–11–CT	860848	860857
M–11–CT	860849	860858

Torque Limiter – T Option



Standard – C/CM/CMV/CV/IC



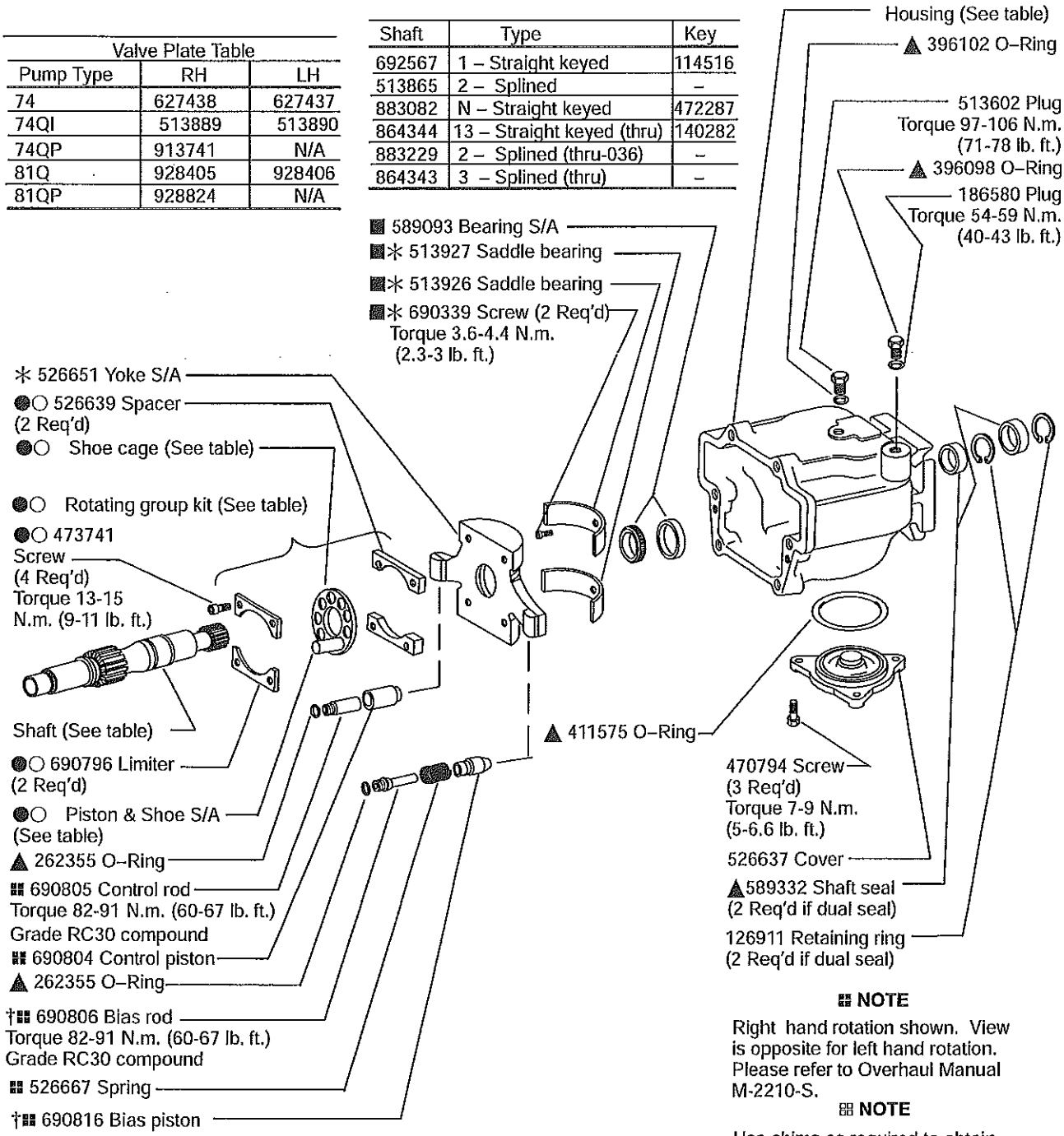
Housing	Flange/Seal
526649	-C-*S
864498	-C-*D
860564	-C2-*S
860814	-C2-*D
864312	-C3-*S
883085	-M-*S

Note
Complete replacement via rotating group kits is recommended.

Model Designation	Piston & Shoe S/A (9 req'd)	Cylinder Block	Shoe Cage	Rotating Group Kit
●74 Size	02-305857	937025	584774	●877421
○81 Size	02-306364	937026	913956	○02-314746

Valve Plate Table		
Pump Type	RH	LH
74	627438	627437
74QI	513889	513890
74QP	913741	N/A
81Q	928405	928406
81QP	928824	N/A

Shaft	Type	Key
692567	1 – Straight keyed	114516
513865	2 – Splined	–
883082	N – Straight keyed	472287
864344	13 – Straight keyed (thru)	140282
883229	2 – Splined (thru-036)	–
864343	3 – Splined (thru)	–



▪ NOTE

Right hand rotation shown. View is opposite for left hand rotation. Please refer to Overhaul Manual M-2210-S.

▪ NOTE

Use shims as required to obtain 0.01–0.10 mm (.0004–.004 in.) axial shaft end play.

NOTE

For satisfactory service life of these components in industrial applications, use full flow filtration to provide fluid which meets cleanliness code 16/14/12 or cleaner.

† Non-torque control models

▲ Available in double shaft seal kit 02-102262

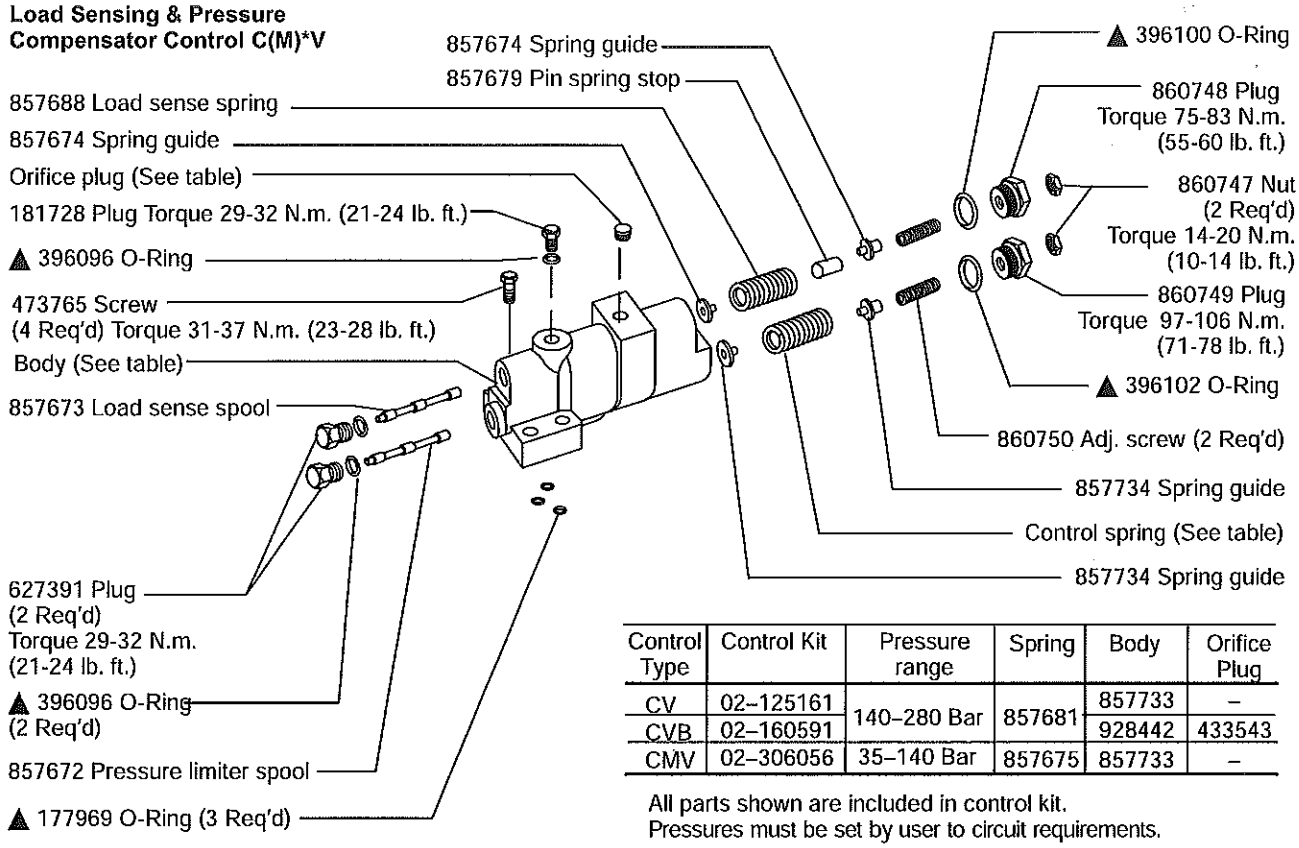
■ Available in bearing kit 877424

✳ Available in bearing/yoke kit 02-334835

● Available in PVH74 rotating group kit.

○ Available in PVH81 rotating group kit.

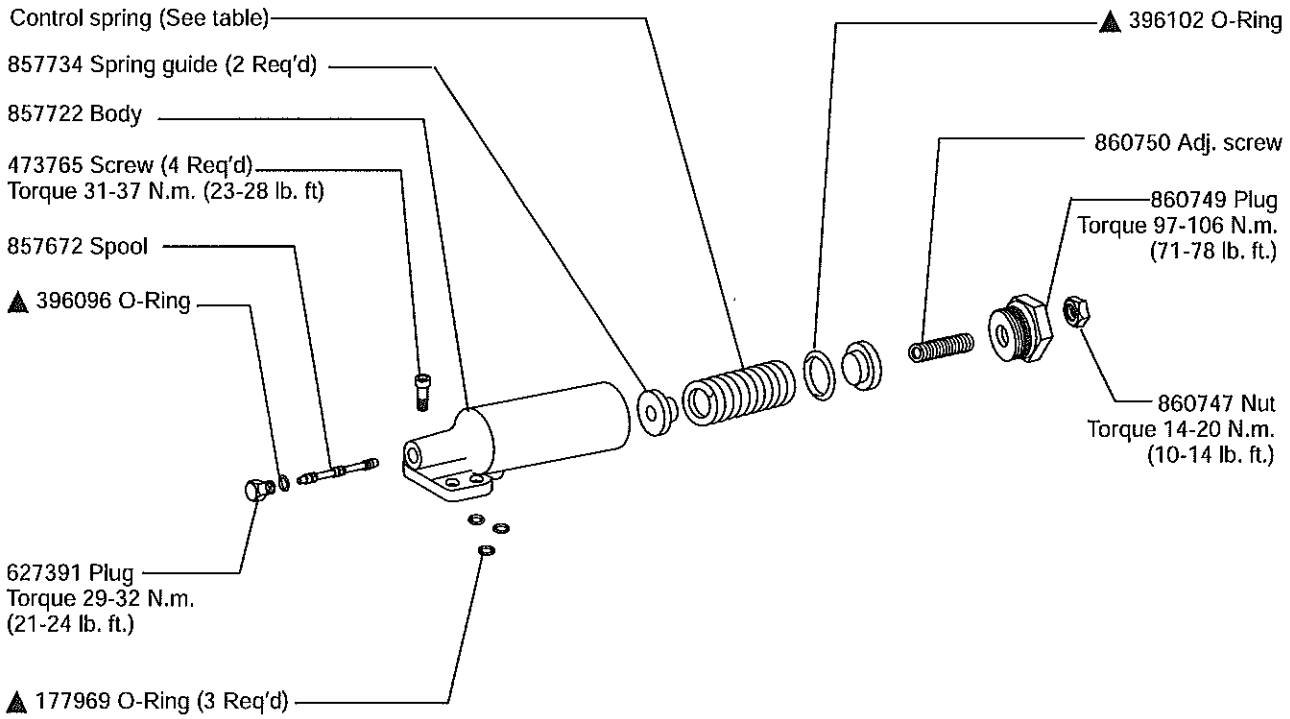
Load Sensing & Pressure Compensator Control C(M)*V



Control Type	Control Kit	Pressure range	Spring	Body	Orifice Plug
CV	02–125161	140–280 Bar	857681	857733	–
CVB	02–160591			928442	433543
CMV	02–306056	35–140 Bar	857675	857733	–

All parts shown are included in control kit.
Pressures must be set by user to circuit requirements.

Pressure Compensator Control C & CM



Control Type	Control Kit	Pressure range	Spring
C	02–125160	140–280 Bar	857681
CM	02–125162	35–140 Bar	857675

All parts shown are included in control kit.
Pressures must be set by user to circuit requirements.

Industrial Control (IC)

473769 Screw (2 Req'd)
Torque 31-37 N.m. (23-28 lb. ft.)
407533 Plug
Torque 12.1-12.4 N.m. (8.9-9.1 lb. ft.)
▲ 396093 O-Ring
▲ 396092 O-Ring (3 Req'd)
627391 Plug (3 Req'd)
Torque 9.8-10.2 N.m. (7.2-7.5 lb. ft.)
Body (see table)
857688 Spring
857679 Pin spring stop
857674 Spring guide (2 Req'd)
▲ 396100 O-Ring
860747 Nut
Torque 14-20 N.m.
(10-14 lb. ft.)
860750 Adj. screw
860748 Plug
Torque 75-83 N.m. (55-60 lb. ft.)

473765 Screw
(2 Req'd) Torque 31-37 N.m. (23-28 lb. ft.)
◇113000 Plug
Torque 5.1-5.9 N.m. (3.7-4.4 lb. ft.)
860566 Orifice plug
Torque 1.7-2.3 N.m.
(1.2-1.7 lb. ft.)
▲ 396096 O-Ring
◇181728 Plug
Torque 29-32 N.m.
(21-24 lb. ft.)
627391 Plug
Torque 29-32 N.m.
(21-24 lb. ft.)
▲ 396096 O-Ring
939816 Spool
▲ 177969 O-Ring
(2 req'd)
▲ 216630 O-Ring

Control Kit	Threads	Body
02–151904	inch	883386
02–151905	metric	860628

All parts shown are included in control kit. Pressures must be set by user to circuit requirements.

◇ NOTE
IC kits pre-set to 20-30 bar differential pressure with all orifices/plugs in place. Reference Vickers Overhaul Manual M-2210-S for proper orifice/plug configuration in various circuits prior to control installation.

Torque Limiter – T Option

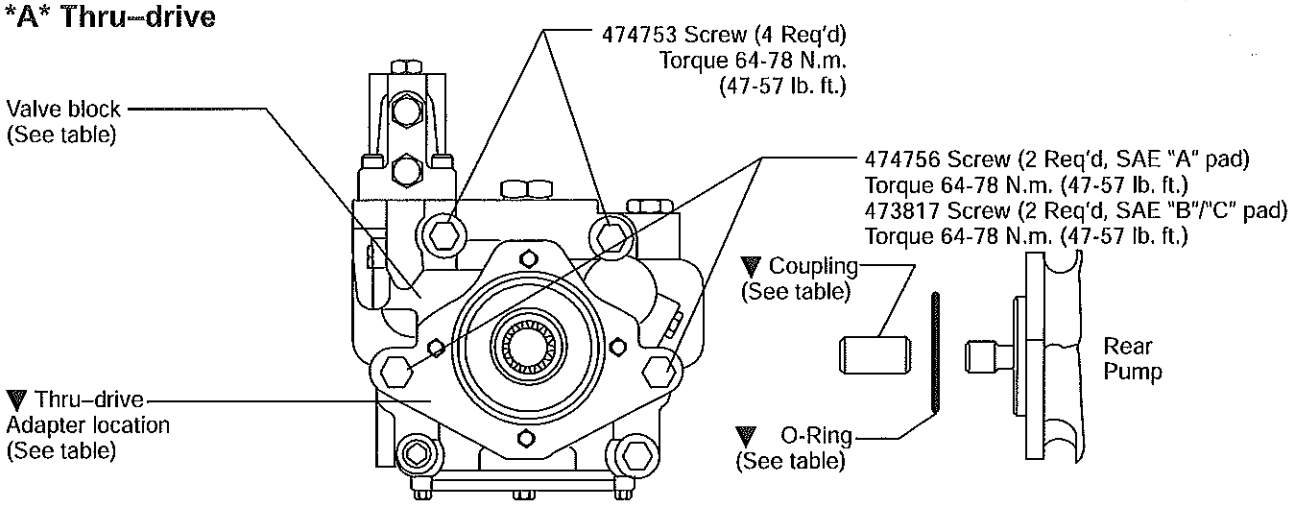
928388 Guide
Spring (See table)
857734 Guide
263069 O-ring
860749 Plug
Torque 75-83 N.m
(102-112 lb. ft.)
860750 Adjusting Screw
860747 Nut
Torque 8-10 N.m
(11-14 lb. ft.)
1649 Ball
471627 Pin
937272 Check valve
Torque 1.7-2.3 N.m
(2.3-3.1 lb. ft.)
217669 O-ring
177969 O-ring
(2 req'd)
913454 Spool
860653 Body
177969 O-ring (5 req'd)
577639 Sleeve
262356 O-ring
248845 Pin
◆932716 Retainer Ring
(Screw into bottom of thread)

913453 Guide
473773 Screw (4 req'd)
Torque to 31-37 N.m
(42-50 lb. ft.)
197594 Back-up ring
262356 O-ring
860655 Plug Torque 75-83
N.m (102-112 lb. ft.)
◆248823 Pin
186580 Plug
Torque 54-59 N.m
(73-80 lb. ft.)
263497 O-ring
113000 Plug
Torque 15-17 N.m
(20-23 lb. ft.)
◆932716Connector
Torque 54-59 N.m
(73-80 lb. ft.)
◆263497 O-ring

Model designation	Control Kit	Spring
C**T**-31	02–314944	857675
C**T**S-31	02–335254	857681

◆Torque summation parts

A Thru–drive

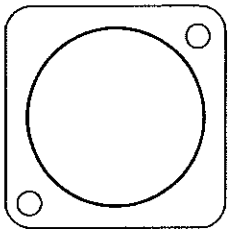


"A" Thru–drive

Model designation	Valve block w/ SAE "A" Pad	O-Ring	Coupling Type
LAF–11–C*	928707	576601	864460 9 tooth SAE-A
LAM–11–C*	928708		
RAF–11–C*	928732		
RAM–11–C*	928733		
LAF–11–CT	860839		
LAM–11–CT	860840		
RAF–11–CT	860830		
RAM–11–CT	860831		

SAE–A, 2–Bolt Cover Plate 939790

(Fits –031 Suffix Pumps)



*AF Units use Screw 170177 (2 req'd)

**AM Units use Screw 470837 (2 req'd)

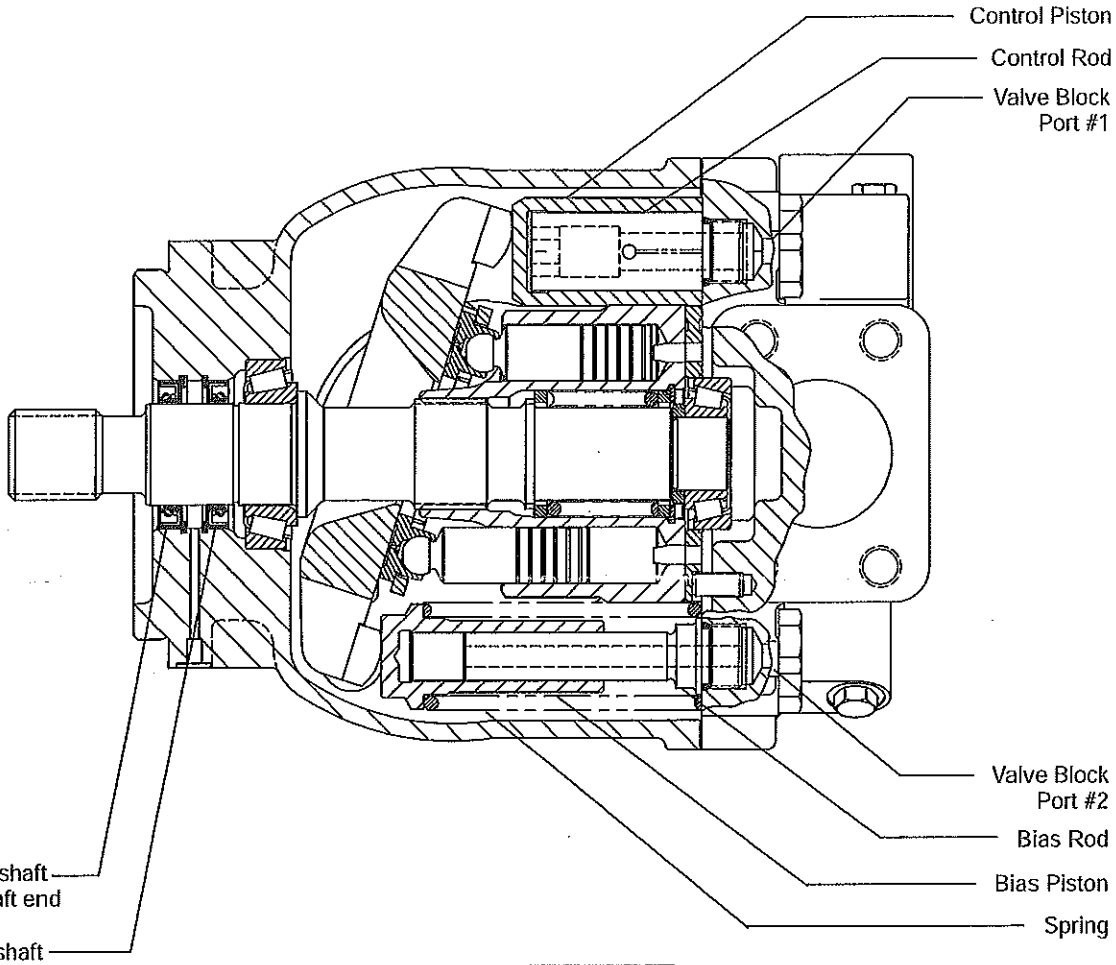
▼"B" & "C" Thru–drive Adapter

Model Designation	Adapter Pad Kit	Adapter Flange	O-Ring	CouplingTypes
*–*BF–11–*	876390	526670	401525	864457 SAE B - 13 tooth
*–*BM–11–*	876394	876393		864459 SAE BB - 15 tooth
*–*CF–11–*	876389	692934	353264	864458 SAE C - 14 tooth
*–*CM–11–*	876392	876391		864461 SAE CC - 17 tooth

Notes:

1. "F" type equal SAE threads
2. "M" type equal metric threads
3. "B" and "C" thru-drives created from "A" thru-drive pump with "B" or "C" thru-drive adapter kit installed.
4. All screws/O-rings are included with each "kit" to convert from "A" to "B" or "C" thru-drive unit.

Typical Cross Section



Note

Parts are shown as installed for right hand rotation. For left hand rotation, install control rod and control piston in valve block port #2. Install bias rod, bias piston and spring in valve block port #2.

Pump Startup

Make sure the reservoir and circuit are clean and free of dirt and debris prior to filling with hydraulic fluid.

Fill the reservoir with filtered oil to a level sufficient to prevent vortexing at suction connection to pump inlet. It is good practice to clean the system by flushing and filtering using an external slave pump.

Before starting the pump, fill with fluid through one of the ports. This is particularly important if the pump is above the fluid level of the reservoir.

When initially starting the pump, remove all trapped air from the system. This can be accomplished by loosening the pump outlet fittings or connections before starting the pump, or by using an air bleed valve. All inlet connections must be tight to prevent air leaks.

Once the pump is started, it should prime within a few seconds. If the pump does not prime, check to make sure that there are no air leaks in the inlet line and connections. Also check to make sure that trapped air can escape at the pump outlet.

After the pump is primed, tighten the loose outlet connections, then operate for five to ten minutes (unloaded) to remove all trapped air from the circuit. If reservoir has a sight gage, make sure the fluid is clear—not milky.

Add fluid to the reservoir up to the proper fill level.

Model Code

PVH ** (Q*) ** - * (*) * - ** * - 11 - ** * (***) (*) (*) - ** - *

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17

1 Piston pump, variable displacement

2 Maximum geometric displacement

74 - 73.7 cm^3/r (4.5 in^3/r)
81 - 80.9 cm^3/r (4.94 in^3/r)

3 Application style

Blank - Mobile application (rated speed & 250/280 bar (3600-4000 psi) pressures)
QI - Quiet industrial application (1500 - 1800 rpm & 250/280 bar (3600-4000 psi) pressures)
QP - Quiet power unit application (1800 rpm & 140 bar (2000 psi) max. pressures – R.H. rotation only)

4 Mounting flange, prime mover end

C - SAE "C" 4–bolt type (SAE J744-127-4)
C2 - Optional combination 2- & 4-bolt SAE-C pilot
C3 - Optional 4-bolt SAE-C pilot for vertical pump mounting
M - Optional metric 4-bolt pilot ISO 3019/2-125B4HW (Must be used with 'N' shaft option.)

5 Shaft rotation, viewed at prime mover end

R - Right hand, clockwise
L - Left hand, counterclockwise

6 Configuration

Blank - Non-thru-drive (single pump)
A - SAE-A thru-drive pump, standard (SAE J744-82-2)
B - SAE-B thru-drive pump, optional (SAE J744-101-2/4)
C - SAE-C thru-drive pump, optional (SAE J744-127-2/4)
S - Adjustable maximum volume stop ("S" option not available on thru-drive and torque control pump models.)

7 Main ports

F - SAE 4-bolt flange ports (standard)
M - SAE 4-bolt pads with metric mounting bolt threads

8 Shaft-end type, at prime mover end

N - Metric ISO short straight key (ISO 3019/2-E32N for "M" pilot only)
1 - SAE-C straight key
2 - SAE-C 14 tooth spline
3 - SAE-CC 17 tooth spline
13 - SAE-CC straight key

9 Shaft seal, prime mover end

S - Single, one-way
D - Double, two-way

10 Pump design number

11 - (Subject to change. Installation dimensions unaltered for design numbers 10 to 19 inclusive.)

11 Pressure control type

C - Compensator, 140-280 bar (2080-4000 psi)
CM - Compensator, 35-140 bar (50-2000 psi)
IC - CETOP 3 interface compensator, 20 bar factory "differential" pressure setting (QI and QP models only)

12 Factory compensator pressure setting

Blank - Leave blank for "IC" controls only
7 - 70 bar (1015 psi) normal "CM7" setting (all pump sizes)
23 - 230 bar (3335 psi) normal "C23" setting (63, 81, 106, 141 models)
25 - 250 bar (3625 psi) normal "C25" setting (57, 74, 98, 131 models)

13 Optional pressure control functions

Blank - Leave blank for basic compensator controls of IC models.
V - Load sensing, 20 bar (290 psi) factory "differential" pressure setting
T - Torque limiting control (Used with sections 14 and 15 .
VT - Load sensing with torque limiting
VB - Load sensing with internal bleed down (0.15" dia. orifice)
VBT- Load sensing with internal bleed down and torque limiting

14 Torque limiting control pressure setting

Blank - Leave blank if no torque limiting control is used
4 - Standard minimum 40 bar setting of "T" torque control option

15 Torque limiting control summation

Blank - Standard torque control
S - Optional torque control with summation feature

16 Control design number

31 - All control options

17 Special feature suffix

031- Mounting with SAE-A, 2-bolt cover plate
036- #2 "C" spline shaft in thru-drive pumps***

*****CAUTION**
Maximum shaft input torque must not exceed 5660 lb-in.

Printed in U.S.A.

Information contained in this catalog is accurate as of the publication date and is subject to change without notice. Performance values are typical values. Customers are responsible for selecting products for their applications using normal engineering methods.

Eaton Hydraulics
15151 Highway 5
Eden Prairie, MN 55344
Telephone: 612 937-7254
Fax: 612 937-7130
www.eatonhydraulics.com

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DNV

ACCREDITED BY THE DUTCH COUNCIL FOR CERTIFICATION Reg. No. 24

ISO-9001 CERTIFICATED FIRM

DET NORSKE VERITAS INDUSTRY BV, THE NETHERLANDS

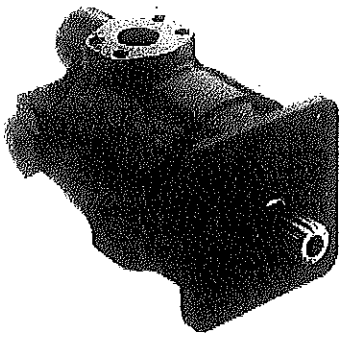
Quality System Certified
Products in this catalog are manufactured in an ISO-9001-certified site.

EATON

Carriage positioning motor

15 SERIES TWO SPEED

PERFORMANCE DATA ENVELOPES DETAILS PREVIOUS HOME



Features of the 15 Series Two Speed Motor:

- All available displacements of standard motor.
- Starting and stall torques equal to 90-94% of theoretical torque.
- Speed to 2,000 RPM continuous.
- Up to 75 HP continuous.
- Conforms to SAE 'C' mounting specification.
- Spool valve shift from full to partial displacement.
- Standard shift ratio is 2:1 - Some special ratios available.
- Shift on the run.
- Typical applications - winch, track, and wheel drives.
- Weighs 51 lbs.
- Basic motor #1561102

331 Broesport San Antonio, Texas 78216
210-341-6333 Fax: 210-341-1231 e-mail: sales@rineer.com

15 SERIES TWO SPEED

15 SERIES TWO SPEED

BACK

VANE CROSSING VANE

The Rineer patented vane crossing vane design produces much higher volumetric and mechanical efficiencies than is possible with a standard vane type design. This design provides a sealing vane between cavities to improve mechanical and volumetric efficiencies.

STARTING AND STALL TORQUE

The Rineer motor produces torque curves which are virtually flat with starting and stall torque equal to approximately 90-94% of theoretical torque.

SEALS

Buna N seals are supplied as standard on the Rineer 15 Series motors. Viton seals may be ordered as an option.

FILTRATION

25 micron minimum

FLUID

We suggest premium grade fluids containing high quality rust, oxidation and foam inhibitors, along with anti-wear additives. For best performance, minimum viscosity should be maintained at 100 SSU or higher. Fluid temperature should not exceed 180° F. Elevated fluid temperature will adversely affect seal life while accelerating oxidation and fluid breakdown. Fire resistent fluids may be used with certain limitations. Contact Rineer for additional information.

MOUNTING

The mounting position is unrestricted. The shafts, pilots, and mounting faces should be within .002 TIR.

INTERMITTENT CONDITIONS

Intermittent conditions are to be less than 10% of every minute.

MORE POWER STROKES PER REVOLUTION

The 15 Series has four stator cavities and 10 rotor vanes. Each rotor vane works in each stator cavity once per revolution, which results in 40 power strokes per revolution. This helps produce higher mechanical efficiency and flatter torque curves.

BEARING LOADING

The bearings in the 15 Series can accept radial load per the radial capacity chart. Thrust load is not recommended under most conditions. Consult with a Rineer Application Engineer for optional bearing configurations to match your application.

ROTATING GROUP - 1S or 1H

Under most operating conditions, 1S (standard rotating group parts) should be used. Under some high speed conditions 1H can be specified.

HORSEPOWER LIMITATION

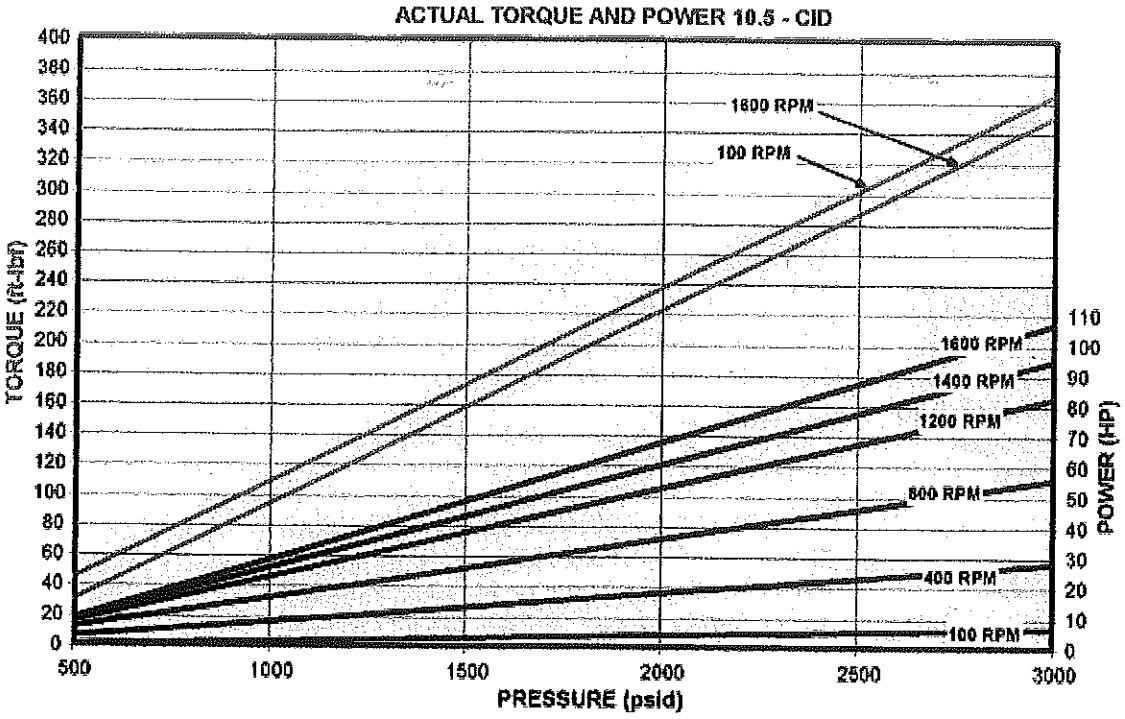
Maximum horsepower limitations may vary with different applications. When using the 15 Series Motor above 75 HP, consult a Rineer Application Engineer.

CASE DRAIN

The 15 Series Motor is designed for either internal or external case drain. Two case drain ports are supplied. When using internal case drain, simply plug the two ports. When using external case drain, use the port at the highest elevation. We recommend case drain pressure of 35 PSI or less when using the standard seals.

CASE DRAIN CIRCULATION

Fluid should be circulated through the case when a temperature differential exists between the motor and the system in excess of 50° F. Should this occur, contact a Rineer Application Engineer.


ACTUAL TORQUE AND POWER 10.5 - CID
TORQUE (ft-lbf)
POWER (HP)
PRESSURE (psid)
1600 RPM
100 RPM
1600 RPM
1400 RPM
1200 RPM
800 RPM
400 RPM
100 RPM
0
20
40
60
80
100
120
140
160
180
200
220
240
260
280
300
320
340
360
380
400
0
10
20
30
40
50
60
70
80
90
100
110
500
1000
1500
2000
2500
3000

TECHNICAL INFORMATION -TWO SPEED MOTOR

DISPLACEMENT CHANGE

When a motor is shifted from full to partial displacement the motor is changed to 50%, 35%, or 28% of its original displacement depending on its shift ratio.

STANDARD SHIFT RATIO

The standard 15 Series displacements of 15, 13, 9.5, 8, 7, and 6 CID are available in the 15 Series Two Speed with a shift ratio of 2:1. For example, a 15 CID motor shifted to partial displacement becomes a 7.5 CID motor.

SPECIAL SHIFT RATIOS

There are two special displacements available in the 15 Series Two Speed which offer higher shift ratios, the 10.5 and the 11.5 CID. The 10.5 CID motor has a shift ratio of 3.5:1, which when shifted becomes a 3 CID motor. The 11.5 CID motor has a shift ratio of 2.875:1, which when shifted becomes a 4 CID motor.

SHIFTING METHOD

electing between full and partial displacement is accomplished by shifting the two-position spool valve incorporated in the motor. Motors are available in either single or double pilot configurations.

SINGLE PILOT

Single pilot motors require a pilot line to be connected to port "C". When port "C" is pressurized the spool shifts the motor to partial displacement. When port "C" is vented to tank, an internal spring shifts the spool, returning the motor to full displacement.

DOUBLE PILOT

Double pilot motors require two pilot lines. One line is connected to port "C" while the other line is connected to port "D". The motor is in full displacement when port "D" is pressurized and port "C" is vented to tank. The motor is in partial displacement when port "C" is pressurized and port "D" is nted to tank.

OPEN DURING CROSSOVER SPOOLS

Open during crossover spools allow port "A" to be directly connected to port "B" when the spool is shifting between full and partial displacement. Motors with -62 or -65 designations are open during crossover. WARNING! IN SOME WINCH APPLICATIONS, OPEN DURING CROSSOVER SPOOLS (-62 or -65) ARE NOT RECOMMMENDED.

CLOSED DURING CROSSOVER SPOOLS

Closed during crossover spools do not allow port "A" to be directly connected to port "B" when the spool is shifting between full and partial displacement. Motors with -63 or -67 designations are closed during crossover. These motors contain an internal factory preset relief valve. This valve protects the motor during shifting only and is not a system relief valve.

PILOT PRESSURE

A minimum of 100 PSI over case drain pressure is required to shift the spool. The maximum allowable pressure to port "C" or "D" is 3,500 PSI.

SHIFT ON THE RUN

The 15 Series Two Speed Motor may be shifted on the run while loaded or unloaded.

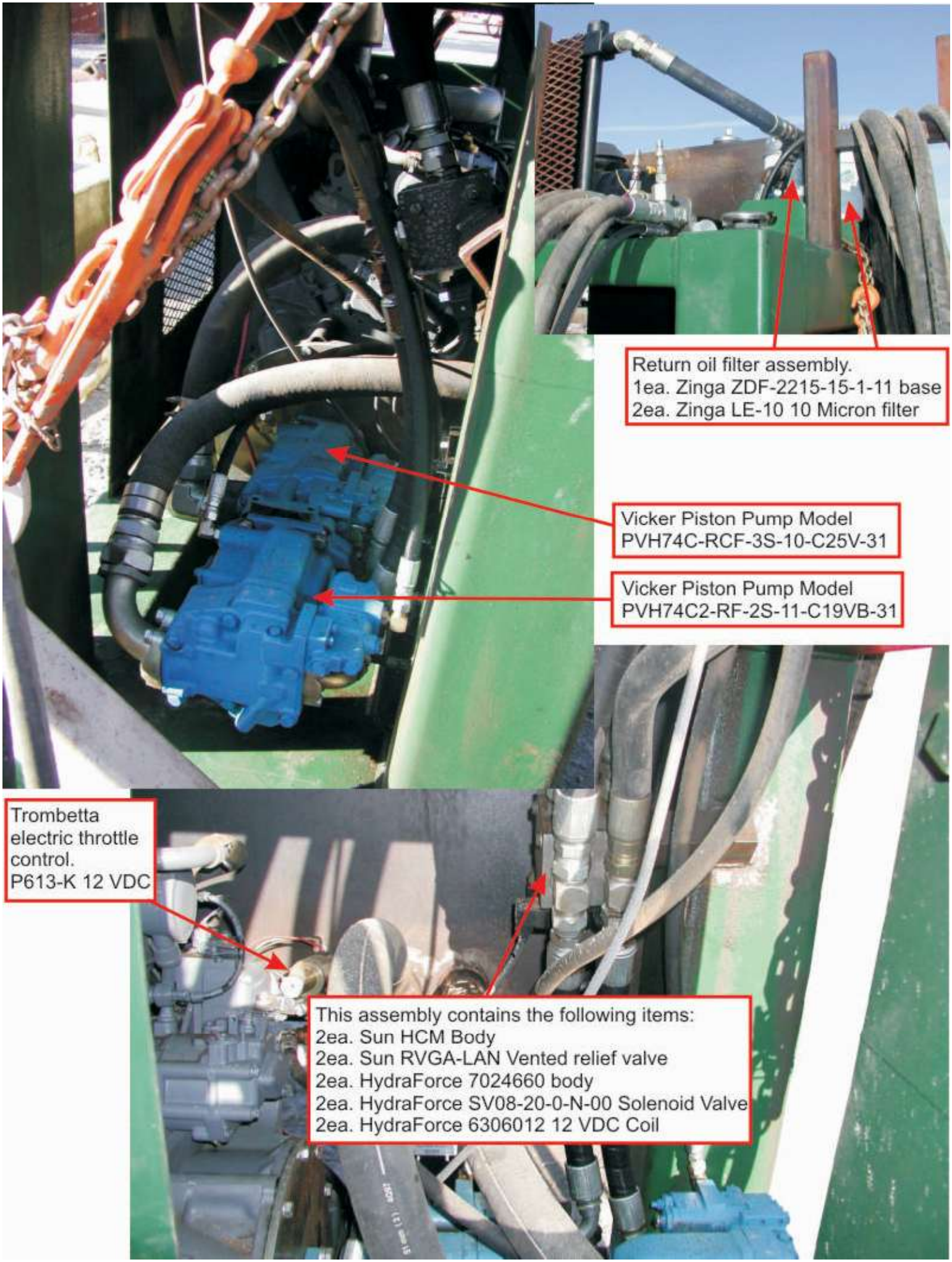
MAXIMUM SPEED

Maximum rated speed is the same for either full or partial displacement as stated in the performance data.

CASE DRAIN AND CROSS PORT LEAKAGE

The combined case drain and cross port leakage of the 15 Series Two Speed Motor is approximately 1 GPM per 1,000 PSI. This will vary with the oil viscosity.


Mot.-Typ.
Code
Mot.-Nr.
kW (G)
kW (S)
1/min
kW (W)
kW (G) red.
kW (S) red.
EP
K
KHD
DEUTZ
MADE IN GERMANY
DEUTZ CORPORATION
3883 Steve Reynolds Blvd.
Norcross, GA 30093
MADE IN GERMANY


Return oil filter assembly.
1ea. Zinga ZDF-2215-15-1-11 base
2ea. Zinga LE-10 10 Micron filter
Vicker Piston Pump Model
PVH74C-RCF-3S-10-C25V-31
Vicker Piston Pump Model
PVH74C2-RF-2S-11-C19VB-31
Trombetta
electric throttle
control.
P613-K 12 VDC
This assembly contains the following items:
2ea. Sun HCM Body
2ea. Sun RVGA-LAN Vented relief valve
2ea. HydraForce 7024660 body
2ea. HydraForce SV08-20-0-N-00 Solenoid Valve
2ea. HydraForce 6306012 12 VDC Coil

Deutz Diesel Hydraulic Power pack

Deutz diesel engine type BFM Motor Type 1011 with a Vickers piggy back piston pump connected to it to provide hydraulic pressure and flow to drive the drill functions. The hydraulic circuit is closed center with load sensing. This means the pumps will have a 450 psi standby and when functions are activated the standby pressure will be 450 psi higher than the highest pressure demand up to 2900 psi for pump 1 and 2610 psi for pump 2.

Werkstatthandbuch

Workshop Manual

Manuel d'Atelier

Manual de Taller

1011 F

0297 7423

DEUTZ

V O R W O R T

Die sachgerechte Ausführung von Reparatur- und Einstellarbeiten ist Voraussetzung für einen zuverlässigen Motorbetrieb.

In diesem Werkstatthandbuch sind die zweckmäßigen Arbeitsabläufe für anfallende Reparatur- und Einstellarbeiten an Motor und Motorbauteilen beschrieben. Dabei wird vorausgesetzt, daß die Arbeiten von qualifiziertem Fachpersonal durchgeführt werden.

Bei der Gestaltung des Werkstatthandbuches wurden im Sinne einer schnellen Erfassung der Inhalte zusätzlich zu den knapp gehaltenen beschreibenden Texten Bildzeichen gesetzt, die den jeweils behandelten Arbeitsgang visualisieren.

Betriebs- und Wartungshinweise sind der entsprechenden Betriebsanleitung zu entnehmen.

Zur Ersatzteilbestellung ist die jeweilige Ersatzteilliste zugrunde zu legen.

Das vorliegende Werkstatthandbuch unterliegt keinem Änderungsdienst. Änderungen werden jeweils bei Neuauflage eingearbeitet.
Beachten Sie bei Reparaturen die Hinweise unserer Technischen Rundschreiben.

Allgemeine Hinweise:

- Lesen und beachten Sie die Informationen dieses Werkstatthandbuches. Sie vermeiden Unfälle und verfügen über einen funktionstüchtigen und einsatzbereiten Motor.

- Stellen Sie sicher, daß dieses Werkstatthandbuch jedem an Reparatur- oder Einstellarbeiten Beteiligten zur Verfügung steht und daß der Inhalt verstanden wird.

- Die Nichtbeachtung dieser Reparaturanleitung kann zu Funktionsstörungen und Motorschäden sowie Verletzungen von Personen führen, für die vom Hersteller keine Haftung übernommen wird.

- Die einschlägigen Unfallverhütungsvorschriften sowie die sonstigen allgemeinen anerkannten sicherheitstechnischen und arbeitsmedizinischen Regeln sind einzuhalten.

- Voraussetzung für die fachgerechte Reparatur ist die Verfügbarkeit aller erforderlichen Ausrüstungen, Hand- und Spezialwerkzeuge, sowie deren einwandfreier Zustand.

- Höchste Wirtschaftlichkeit, Zuverlässigkeit und lange Lebensdauer ist nur bei Verwendung von Original Teilen der DEUTZ AG sichergestellt.

- Motorteile wie Federn, Klammern, elastische Halteringe etc. beinhalten bei unsachgemäßer Behandlung erhöhte Verletzungsgefahr.

- Die Instandsetzung des Motors muß der bestimmungsgemäßen Verwendung - definiert durch den Gerätehersteller - entsprechen. Bei Umbauten dürfen nur von der DEUTZ AG für den jeweiligen Verwendungszweck freigegebene Teile eingesetzt werden.

F O R E W O R D

Reliable engine operation is dependent on properly executed repairs as well as adjustment work.

This Workshop Manual describes the appropriate operations for any repair and adjustment work on the engine and engine components. It is presumed that this work will be carried out by qualified personnel.

This operation manual has been designed for quick and easy understanding. Therefore the concise text passages are accompanied by pictographs to illustrate the relevant operation.

Aspects of operation and maintenance are dealt with in the respective Operation Manual.

For spare parts orders the respective spare parts catalogue should be referred to.

This Workshop Manual is not subject to engineering change service and is valid until next issue.

Therefore please refer to the information in our Technical Circulars when carrying out repairs.

General information:

- Please read carefully and observe the instructions given in this Workshop Manual to avoid accidents and ensure that your engine always functions properly and reliably.

- Make sure that this Workshop Manual is readily available for all those carrying out repairs or adjustments and that the contents are well understood.

- Non-compliance with these repair instructions may result in malfunction and engine damage as well as personal injuries for which the manufacturer shall not accept any liability.

- The accident prevention regulations and all other generally recognized regulations on safety and occupational medicine are to be observed.

- A prerequisite for successful repair is that all required equipment, hand and special tools are available and in perfect working order.

- Optimal operation economy, reliability and durability of the engine can only be ensured when genuine parts of DEUTZ AG are used.

- Engine components such as springs, clamps, snap rings, etc. may cause injury if not handled with care.

- Engine repairs must be carried out in accordance with intended use as defined by the equipment manufacturer. For conversions, only parts approved by DEUTZ AG for a specific purpose should be used.

PRÉFACE

Un fonctionnement fiable du moteur suppose l'exécution en bonne et due forme des travaux de réparation et de réglage.

Le présent Manuel d'atelier décrit la suite des travaux de réparation et de réglage à effectuer sur le moteur et ses éléments. Cela suppose que les travaux sont réalisés par un personnel spécialisé et qualifié.

En vue d'une compréhension rapide du contenu, le manuel d'atelier comporte, en plus des textes brefs, des symboles visualisant l'opération à réaliser.

Les indications relatives au service et à l'entretien figurent dans les instructions de service correspondantes.

Pour la commande de pièces de rechange, il convient de se baser sur la liste des pièces de rechange correspondante.

Le présent manuel d'atelier n'est soumis à aucun service de modifications. Les modifications seront incorporées à chaque réédition du Manuel.

Pour les réparations, veuillez respecter les indications de nos circulaires techniques.

Remarques générales:

- Veuillez lire attentivement les informations du présent Manuel d' Atelier et en tenir compte. Vous éviterez ainsi des accidents et disposerez en même temps d' un moteur fonctionnel et en parfait état de marche.

- Assurez-vous que chaque personne chargée des travaux de réparation et de mise au point dispose bien de ce Manuel d' Atelier et en comprenne bien le contenu.

- Le non-respect de ces instructions de réparation peut entraîner des pannes, avaries de moteur et accidents de personnes, pour lesquels le constructeur ne peut en aucun cas assumer la responsabilité.

- Il convient de respecter les consignes générales de sécurité et de prévention des accidents en vigueur.

- La condition préalable de la bonne exécution des réparations est la mise à disposition de tous les équipements, outillages manuels et spéciaux requis, en parfait état de fonctionnement.

- Seule l'utilisation de pièces de rechange d'origine DEUTZ AG garantit une rentabilité et fiabilité optimales ainsi qu'une longue durée de vie.

- Les éléments du moteur notamment les ressorts, attaches, bagues élastiques etc., peuvent entraîner, en cas de non-respect des prescriptions, des blessures graves.

- La remise en état du moteur doit répondre à son utilisation propre, définie par le constructeur de l'engin. En cas de modification, seules les pièces autorisées par DEUTZ AG dans le cas de l'application concernée, peuvent être utilisées.

P R O L O G O

Una ejecución competente de trabajos de reparación y ajuste es requisito fundamental para un funcionamiento seguro del motor.

En el presente manual para talleres han sido descritos los ciclos convenientes de trabajo para reparaciones y ajustes del motor y de sus componentes. Se presupone, no obstante, que los trabajos serán realizados por personal técnico especializado.

Con el fin de simplificar la comprensión del contenido del manual para talleres, se han agregado símbolos significativos a los textos explicatorios, visualizando así el trabajo a realizar.

Informaciones con respecto al manejo y al servicio de entretenimiento del motor, se encuentran en el Manual de Instrucciones de Servicio correspondiente.

Para pedidos de repuestos servirá de base el respectivo catálogo de repuestos.

El presente manual para talleres no está sujeto a un servicio continuado de modificaciones e innovaciones. Cada nueva edición incluye todas las modificaciones del caso.

Al efectuar reparaciones, aconsejamos asimismo tomar en cuenta las advertencias pertinentes de nuestras circulares técnicas.

Advertencias generales:

- Le recomendamos la detenida lectura y observancia de las informaciones contenidas en este Manual de taller. Así evitará accidentes y dispondrá de un motor que funciona perfectamente.

- Haga lo necesario para que este Manual esté a disposición de toda persona que participe en trabajos de reparación y ajuste, y cuide de que sí comprenda el contenido.

- Al no tenerse en cuenta estas instrucciones de reparación, podrán surgir perturbaciones en el funcionamiento y averías en el motor así como lesiones de personas para las cuales el fabricante no asume responsabilidad alguna.

- Se cumplirán las normas aplicables para la prevención de accidentes así como todas las demás normas de seguridad y medicina laboral generalmente aceptadas.

- Es condición para la correcta reparación que estén disponibles todos los requeridos equipos, herramientas manuales y especiales en perfecto estado.

- Máxima rentabilidad, fiabilidad y larga duración quedan garantizadas únicamente al emplearse repuestos originales de DEUTZ AG.

- Piezas del motor, tales como resortes, garras, aros de sujeción elásticos, etc. , aumentan en caso de tratamiento incorrecto el peligro de lesiones.

- El reacondicionado del motor deberá corresponder al empleo previsto definido por el fabricante del equipo. En caso de transformaciones, se deberán emplear únicamente piezas admitidas por DEUTZ AG para el respectivo uso previsto.

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Technische Daten

Specification data

Caractéristiques techniques

Datos técnicos

1011 F

Hinweis zum Gebrauch des Werkstatthandbuches
In diesem Werkstatthandbuch sind alle technischen Daten, Einstellwerte und Anziehvorschriften den Stellen zugeordnet, wo sie bei Servicearbeiten, De- und Montage am Motor benötigt werden.

Notes for the user of this Workshop Manual
In this Workshop Manual all specification data, adjustment values and tightening specifications are allocated to those parts where they are needed for service work, disassembly and reassembly on the engine.

Remarque quant à l'utilisazion du Manuel d'atelier
Dans le présent Manuel d'atelier, toutes les caractéristiques techniques, valeurs de réglage et préconisations de serrage nécessaires se trouvent dans les chapitres correspondant aux travaux de service après-vente et montage et démontage du moteur.

Indicación para el uso del manual de taller
En este manual de taller se indican todos los datos técnicos, valores de ajuste y prescripciones de apriete en los puntos donde son requeridos para la realización de trabajos de servicio, desmontaje y montaje en el motor.

DEUTZ

Deutsch

Werkstatthandbuch 1011 F

1. Technische Daten

Seite

English

1. Specification data

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Français

1. Caractéristiques techniques

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Español

1. Datos técnicos

Página

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Deutsch	English	Français	Español
Motorgewicht ohne Starter, mit Generator ca. kg	Engine weight without starter with generator approx. kg	Poids du moteur sans démarreur avec génératrice approx. kg	Peso del motor sin arrancador, con generador aprox. kg
Gesamthubvolumen cm^3	Engine swept volume cm^3	Cylindrée totale cm^3	Cilindrada total cm^3
Bohrung mm	Bore mm	Alésage mm	Calibre mm
Hub mm	Stroke mm	Course mm	Carrera mm
Drehrichtung	Direction of rotation	Sens de rotation	Sentido de giro
Nenndrehzahl max. 1/min	Rated speed max. rpm	Régime nominal maxi tr/mn	Régimen nominal máx. r/min
Niedrigste Leerlaufdrehzahl 1/min	Minimum idle speed rpm	Ralenti extrême tr/mn	Régimen mín. en vacío r/min
Arbeitsweise	Working cycle	Principe de fonction-nement	Sistema de trabajo

F2 - 4L 1011 F	BF4L 1011 F	F3 - 4M 1011 F	BF4M 1011 F
F2L = 167 F3L = 208 F4L = 250	257	F3M = 200 F4M = 243	249
F2L = 1366 F3L = 2049 F4L = 2732	2732	F3M = 2184 F4M = 2912	2912
91			
105		112	
auf Schwungrad gesehen links When facing flywheel counter-clockwise Vu sur volant à gauche Mirándose sobre el volante a izquierdas			
3300	3000	3000	2800
900±50			
Viertakt - Diesel Four-stroke diesel Diesel 4 temps Diesel a 4 tiempos			

Werkstatthandbuch 1011 F

Deutsch	English	Français	Español
Verbrennungs-verfahren	Combustion system	Principe de combustion	Sistema de combustión
Verdichtungs-verhältnis	Compression ratio	Taux de compression	Relación de compresión
Kompressionsdruck bar	Compression pressure bar	Compression bars	Pressión de compresión bar
Zündfolge	Firing order	Ordre d'allumage	Orden de encendido
Abmessungen des Motors mit Anschlußgehäuse (normal)	Dimensions of engine incl. standard flywheel	Dimensions du moteur avec volant standard	Dimensiones del motor con volante (normal)
größte Länge mm	Max. length mm	Longueur HT mm	Longitud máx. mm
größte Breite mm	Max. width mm	Largeur HT mm	Anchura máx. mm
größte Höhe mm	Max. height mm	Hauteur HT mm	Altura máx. mm

F2 - 4L 1011 F	BF4L 1011 F	F3-4M 1011 F	BF4M 1011 F
Direkteinspritzung Direct injection Injection directe Inyección directa			
18,5	17	18,5	17
1 - 2 1 -2 - 3 1 -3 - 4 - 2	1 -3 - 4 - 2	1 -2 - 3 1 -3 - 4 - 2	1 -3 - 4 - 2
F2L = 487 F3L = 599 F4L = 710	710	F3M = 599 F4M = 710	710
451	495	451	495
F2L = 683 F3L = 678 F4L = 703	703	F3M = 678 F4M = 703	703

Werkstatthandbuch 1011 F

Deutsch	English	Français	Español
Steuerzeiten ohne Stößel- und Ventilspiel	Valve timing without valve clearance	Calage distribution sans jeu aux culbuteurs réglé	Cotas de reglaje sin juegos de válvulas y de empujadores
Einlaß öffnet vor OT Grad	Inlet opens before TDC degrees	Admission ouvre avant PMH degrés	Admisión abre a. PMS grados
Einlaß schließt nach UT Grad	Inlet closes after BDC degrees	Admission ferme après PMB degrés	Admisión cierra t. PMI grados
Auslaß öffnet vor UT Grad	Exhaust opens before BDC degrees	Echappement ouvre avant PMB degrés	Escape abre a. PMI grados
Auslaß schließt nach OT Grad	Exhaust closes after TDC degrees	Echappement ferme après PMH degrés	Escape cierra t. PMS grados
Schmieröldruck in niedrigem Leerlauf Temperatur ca. 110° C Öl SAE 20W/20 Minimum bar	Lube oil pressure at low idling Temperature approx. 110° C oil SAE 20W/20 min. bar	Pression d'huile au bas ralent température ca. 110° C huile SAE 20W/20 mini bars	Presión de aceite lubricante a marcha lenta en vacío Temperatura aprox. 110° C aceite SAE 20W/20 mín. bar
Absteuerventil bar	Pressurestat bar	Clapet régulateur final bars	Válvula reguladora final bar

F2 - 4L 1011 F	BF4L 1011 F	F3 - 4M 1011 F	BF4M 1011 F
45	47	45	47
65	63	65	63
76	99,5	76	99,5
44	51,5	44	51,5
1,4			
F2 -3L = 6,5 F4L = 7	7	F3L = 6,5 F4L = 7	7

Technische Daten
Specification data
Caractéristiques techniques
Datos técnicos

Ventilspieleinstellschema
Schematic for valve clearance adjustment
Schéma de réglage des soupapes
Esquema para el ajuste de holgura de válvulas

Werkstatthandbuch 1011 F

1 1

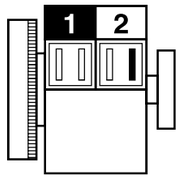
Kurbelwellenstellung **1**

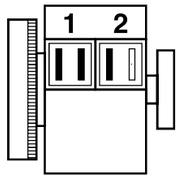
Motor bis zum Erreichen der Ventilüberschneidung am Zyl. Nr. 1 durchdrehen.

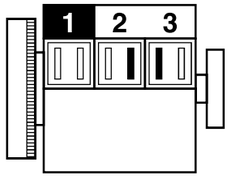
Kurbelwellenstellung **2**

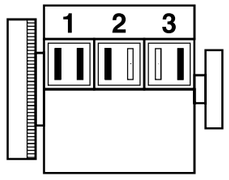
Motor um eine volle Umdrehung (360°) weiterdrehen.

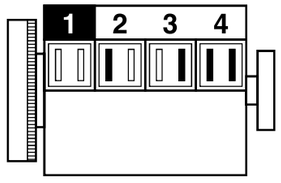
nicht einstellbar — einstellbar

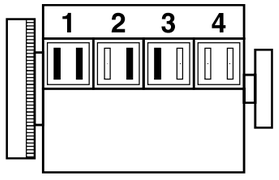












English

Crankshaft position **1**

Turn engine until valves of cylinder No. 1 overlap.

Not ready for adjustment.

Crankshaft position **2:**

Turn engine further by one complete revolution (360°).

Ready for adjustment.

Français

Position de l'arbre à cames **1**

Virer le moteur jusqu'au chevauchement des soupapes au cylindre 1.

non réglable

Position de l'arbre à cames **2**

Tourner le moteur d'un tour complet (360°)

réglable

Español

Posición del cigüeñal **1**

Gírese el motor, hasta que las válvulas del cilindro N° 1 coincidan en su posición momentánea.

no ajustable

Posición del cigüeñal **2**

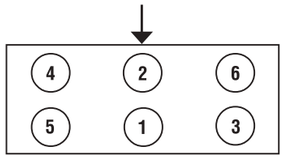
Continuese girando el motor por una rotación completa (360°)

ajustable

1.00.09

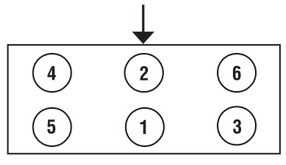
Reihenfolge beim Anziehen der Zylinderkopfschrauben
Tightening order for cylinder head bolts
Ordre à respecter lors du serrage d'approche et définitif des vis de cul.
Sucesión de los trabajos al apretar los tornillos de culata

Krümmerseite,Manifold side,
Coté coudes, Lado codo



2-Zylinder
2-cylinder
2-cylindres
2 cilindros

Krümmerseite,Manifold side,
Coté coudes, Lado codo



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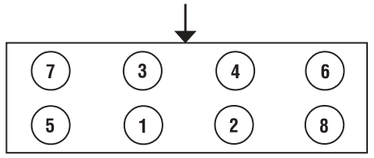
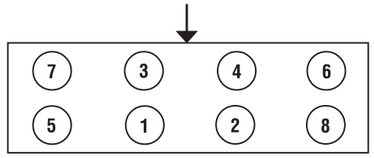
2-cylindres
2 cilindros

Krümmerseite,Manifold side,
Coté coudes, Lado codo



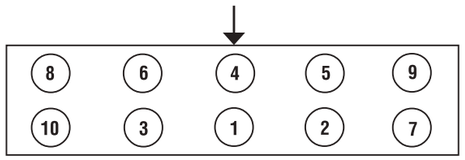
3-Zylinder
3-cylinder
3-cylindres
3 cilindros

Krümmerseite,Manifold side,
Coté coudes, Lado codo



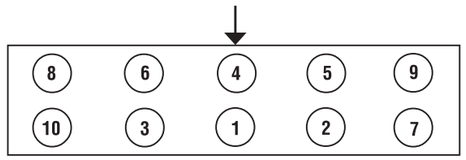
3-Zylinder
3-cylinder
3-cylindres
3 cilindros

Krümmerseite,Manifold side,
Coté coudes, Lado codo



4-Zylinder
4-cylinder
4-cylindres
4 cilindros

Krümmerseite,Manifold side,
Coté coudes, Lado codo



4-Zylinder
4-cylinder
4-cylindres
4 cilindros

Werkstatthandbuch 1011 F

1 1

Zerlegen von Baugruppen	Personenschäden verhüten Hinweis auf Gefahrenstelle
Zusammenbauen zu einer Baugruppe	Materialschaden verhüten Teilbeschädigung
Abbauen - Ausbauen behindernder Teile	Unterbauen - Abstützen - Abfangen
Einbauen - Anbauen Teile, die beim Ab-/ Ausbau hinderten	Einölen
Achtung, wichtiger Hinweis	Einfetten
Prüfen - Einstellen z. B. Drehmomente, Maße, Drücke usw.	Markieren vor dem Zerlegen, beachten beim Zusammenbau
Spezialwerkzeug	Wuchten Ausgleichen von Unwuchten
Einbaurichtung beachten	Einfüllen - Auffüllen - Nachfüllen z. B. Öl, Kühlwasser usw.
Kontrollieren - Prüfen Sichtprüfung	Ablassen z. B. Öl, Kühlwasser usw.
Bedingt wiederverwendbar Bei Bedarf auswechseln	Lösen z. B. Lockern einer Spanneinrichtung
Beim Zusammenbau immer erneuern	Spannen z. B. Anziehen einer Spanneinrichtung
Entsichern - Sichern z. B. Splint, Sicherungsblech usw.	Entlüften
Sichern - Kleben z. B. Dichtmittel flüssig	Spanabhebende Bearbeitung

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1.00.13

Werkstatthandbuch 1011 F

Disassembly of assembly groups	Guard against personal injury Indication of hazard
Reassembly to form assembly group	Guard against material damage Damage to parts
Remove obstructing parts	Prop up - Support - Hold
Reinstall - Remount parts which had obstructed disassembly	Oil
Attention! Impartant notice!	Grease
Check - Adjust e. g. torque dimensions, pressures, etc.	Mark before disassembly, observe marks when reassembling
Special tool	Balance Eliminate any imbalance
Note direction of installation	Filling - Topping up - Refilling e. g. oil, cooling water, etc.
Visual inspection	Drain off e. g. oil, cooling water, etc.
Possibly still serviceable Renew if necessary	Loosen - Release e. g. loosening a clamping device
Renew at each reassembly	Tighten - Clamp e. g. tightening a clamping device
Unlock - Lock e. g. split pin, locking plate, etc.	Vent
Lock - Adhere e. g. with liquid sealant	Machining process

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1.00.13

Werkstatthandbuch 1011 F

Déassemblage d'un ensemble constructif	Prévention aux accidents profession attirer l'attention sur un risque eventuel d' accident
Assemblage des composants d'un ensemble constructif	Prévention à la détérioration de matériels Risque d'endommager des piéces
Démontage d'eléments entravant l'accés	Monter sur tréteaux - freiner par sabots - immobiliser par un moyen quelconque
Remontage - Remise en place d'eléments qui entravaient l'accés	Huiler
Remarque importante!	Graisser employer lubrificant plastique
Utilisation impérative p. ex.: couple-moteur, cotes, pressions etc.	Repérage en cours de démontage permet un remontage correct!
Utilisation impérative d'un outil specialise	Equilibrer éliminer le balourd
Respecter l'ordre de montage	Premier garnissage - remplissage - garnissage d'appoint p. ex.: Huile eau de refroidissement etc.
Vérification - Contrôle à vue	Vidanger - soutirer p. ex.: Huile eau de refroidissement etc.
Réutilisation sous certaines conditions à remplacer,si besoin est	Desserrer p. ex.: desserrage d'un dispositiv
A remplacer systématiquement lors de remontage	Serrer p. ex.: serrage entre un dispositif
Arracher la goupille - goupiller freiner par tôle-arrétoir	Faire la purge d'air
Freiner - coller p. ex. avec páte hermétique, ou frein liquide	Usinage par enlèvement de copeaux

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Werkstatthandbuch 1011 F

Desarmar grupos de construcción		Evitar accidentes indica puntos de peligro	
Rearmar un grupo de construcción		Evitar daños materiales averia de piezas	
Desmontar partes que puedan estorbar		Calzar - Apoyar	
Montar - Incorporar partes que puedan estorbar en el desmontaje		Aceitar	
!Atención! Indicación importante		Engrasar	
Verificar - Graduar - Ajustar (p. ej. pares, medidas, presiones)		Marcar antes del desmontaje - controlar la marcación en el remontaje	
Herramienta especial		Equilibar Aeliminar desequilibros o excentricidad	
Observar la dirección de montaje		Lienar - Rellenar - Completar p. ej. aceite, agua refrigerante, etc.	
Control verificación visual		Evacuar - Vaciar p. ej. aceite, agua refrigerante, etc.	
Re-utilización condicional sustituir en caso necesario		Soltar p. ej. un sistema de fijación o tensado	
Sustituir en cada montaje		Tensar - Apretar p. ej. un sistema de fijación o tensado	
Desafianzar - Afianzar (mecánicamente) (p. ej. pasador de aletas, chapa de seguridad, etc.)		Purgar el aire	
Afianzar - Pegar p. ej. con medio liquido		Mecanización con arranque de virutas	

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1.00.13

Prüfen und Einstellen

Checking and adjusting

Contrôle et réglage

Verificación y ajustes

1011 F

DEUTZ

Deutsch

Werkstatthandbuch 1011 F

2. Prüfen und Einstellen

Seite

English

2. Checking and adjusting

Page

Français

2. Contrôle et réglage

Page

Español

2. Verificación y ajustes

Pagina

English

The standard valve clearance can be adjusted:

with engine cold or warm after cooling down for at least **0.5 h.**

Oil temperature ≤ **80°C**.

Note: The valve clearance is to be increased by 0.1 mm at every cylinder head gasket renewal. The standard valve clearance is to be adjusted after completion of **500 hours** of operation.

Cylinder head cover has been removed.

1. Turn engine until valves of cyl. No. 1 overlap.

For valve clearance adjustment schematic see Specification Data.

Note: Valves overlapping means: Exhaust valve about to close. Inlet valve about to open. Neither pushrod can be turned in this position.

2. Adjust valve clearance on respective cylinder with feeler gauge.

Note: Inlet valve clearance: **0.3 mm**
Exhaust valve clearance: **0.5 mm**

3. Tighten locknut.

   Tightening specification: **20 ±2 Nm**

   Recheck the adjustment with feeler gauge.

Français

Le réglage standard du jeu des soupapes est possible

sur moteur froid ou chaud après une période de refroidissement d'au moins **30 minutes**.

Température de l'huile ≤ **80°C.**

Nota: à chaque changement du joint de culasse augmenter le jeu aux soupapes de 0,1 mm. Après **500 heures** de marche procéder au réglage standard du jeu des soupapes.

Le cache-culbuteurs a été déposé.

1. Virer le moteur jusqu'à ce que les soupapes soient en bascule, cyl. no. 1.

Schéma de réglage du jeu aux soupapes voir caractéristiques techniques.

Nota: le chevauchement des soupapes signifie: soupape d'échappement pas encore fermée et soupape d'admission commence à s'ouvrir. Les deux tiges de culbuteurs ne peuvent plus tourner.

2. Régler le jeu des soupapes au cylindre correspondant avec une jauge d'épaisseur.

Nota: Jeu soupape ADM: **0,3 mm**
Jeu soupape ECH: **0,5 mm**

3. Serrer le contre-écrou

   Consigne de serrage **20 ± 2 Nm**

   Effectuer un nouveau contrôle du serrage avec une jauge d'épaisseur.

Español

El ajuste del juego estándar de válvulas es posible:

Con el motor frío o con el motor caliente después de un período de enfriamiento de por lo menos **media hora**.
Temperatura del aceite: ≤ **80°C.**

Nota: El juego de válvulas debe aumentarse por 0,1 mm a cada cambio de la junta de culata,. Tras **500 horas** de servicio se ajustará el juego estándar.

La tapa de culata está desmontada.

1. Girar el cigüeñal hasta que se crucen las válvulas en el cilindro 1.

Para el esquema de ajuste del juego de válvulas, véanse los Datos Técnicos.

Nota: Cruce de válvulas significa: La válvula de escape aún no está cerrada y la de admisión comienza a abrirse. En esta posición, no es posible girar las dos varillas de empuje.

2. Ajustar el juego de válvulas en el cilindro correspondiente mediante la galga de espesores.

Nota: Juego de válvulas
- admisión: **0,3 mm**
- escape: **0,5 mm**

3. Apretar la contratuerca.

   Prescripción de apriete: **20 ± 2 Nm**.

   Comprobar nuevamente el ajuste efectuado, mediante la galga de espesores.

Deutsch

Die Standard-Ventilspieleinstellung ist möglich:

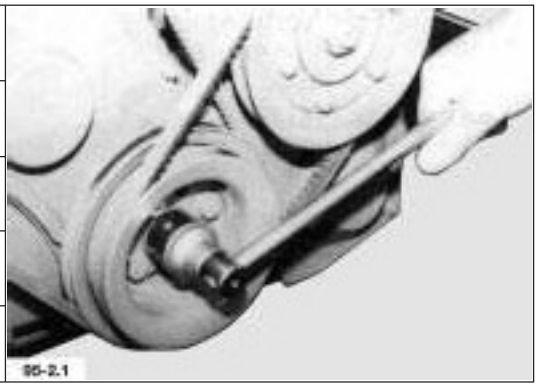
Am kalten- oder am warmen Motor nach einer Abkühlzeit von mindestens **0,5 h**.
Öltemperatur ≤ **80° C**

Hinweis: Bei jedem Zylinderkopf-Dichtungswechsel ist das Ventilspiel um 0,1 mm zu erhöhen.
Nach **500 Bh** ist das Standard-Ventilspiel einzustellen.

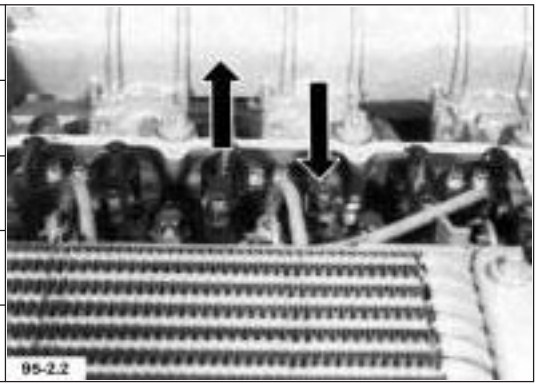
Zylinderkopfhaube ist abgebaut

1. Motor durchdrehen bis zum Erreichen der Ventilüberschneidung, Zyl. Nr. 1.

Ventilspieleinstellschema
siehe Techn. Daten



Hinweis: Ventilüberschneidung bedeutet:
Auslaßventil ist noch nicht geschlossen, Einlaßventil beginnt zu öffnen.
Dabei sind beide Stoßstangen nicht drehbar.



2. Ventilspieleinstellung am entsprechenden Zylinder mit Fühlerlehrenblatt einstellen.

Hinweis: Ventilspiel Einlaß: **0,3 mm**
Ventilspiel Außlaß: **0,5 mm**

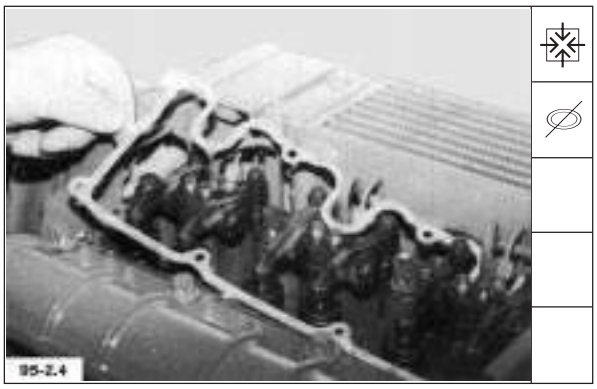
3. Kontermutter festdrehen.

   Anziehvorschrift: **20 ± 2 Nm**

   Einstellung nochmals mit Fühlerlehrenblatt überprüfen.

Werkstatthandbuch 1011 F

Deutsch



4. Dichtung aufsetzen.

5. Zylinderkopfhaube montieren. Schrauben festdrehen.

   Anziehvorschrift: **8,5 Nm**

English

4. Put gasket in place.

5. Fit cylinder head cover. Tighten bolts.

   Tightening specification: **8.5 Nm**

Français

4. Mettre en place le joint.

5. Monter le cache-culbuteurs. Bloquer les vis.

   Consigne de serrage: **8,5 Nm.**

Español

4. Colocar la junta.

5. Montar la tapa de culata. Apretar los tornillos.

   Prescripción de apriete: **8,5 Nm.**

English

Commercial tools required:

Compression tester _____ 8005
Torx tool kit _____ 8189

Special tools required:

Connector _____ 100 120
Special wrench
for injection line _____ 110 490

Injectors have been removed, valve clearance has been checked.

1. Insert connector with new special seal.
2. Fit clamping pad. Tighten bolt.
3. If necessary, screw on adapter for connector.

Français

Outillage usuel:

Compressiomètre _____ 8005
Jeu d'outils Torx _____ 8189

Outil spécial:

Pièce de raccordement ____ 100 120
Clé spéciale pour
conduite d'injection _____ 110 490

Les injecteurs ont été déposés et le jeu des soupapes contrôlé.

1. Mettre en place la pièce de raccordement avec un joint spécial neuf.
2. Placer la griffe de serrage et serrer le boulon.
3. Si nécessaire mettre en place l'adaptateur de la pièce de raccordement.

Español

Herramientas comerciales:

Compresímetro _____ 8005
Juego de herramientas Torx ___ 8189

Herramientas especiales:

Pieza de empalme _____ 100 120
Llave especial para
tubo de inyección _____ 110 490

Los inyectores están desmontados y el juego de válvulas está controlado.

1. Introducir la pieza de empalme con la junta especial nueva.
2. Colocar la garra de sujeción. Apretar el tornillo.
3. De ser necesario, enroscar el adaptador para la pieza de empalme.

Deutsch

Handelsübliche Werkzeuge:

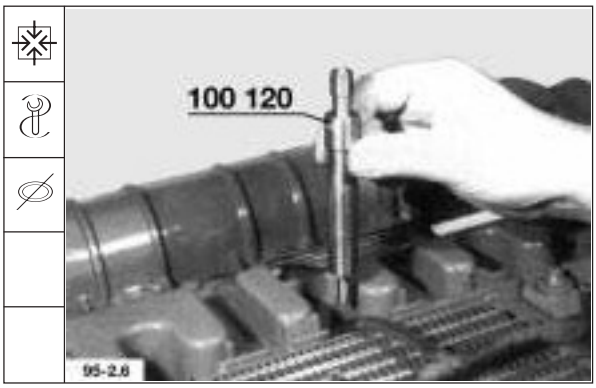
Kompressionsdruckprüfer _____ 8005
Torx-Werkzeugsatz _____ 8189

Spezialwerkzeuge:

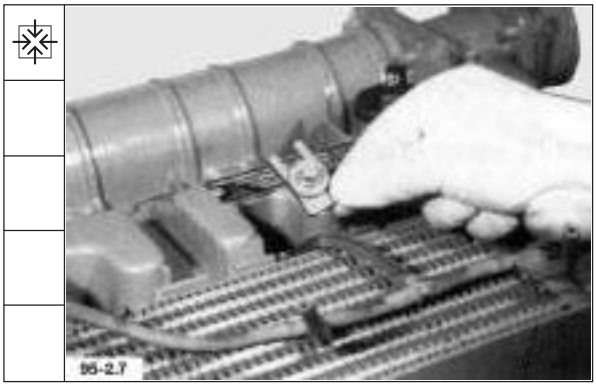
Anschlußstück _____ 100 120
Spezialschlüssel für Einspritzleitung __110 490

Einspritzventile sind ausgebaut, Ventilspiel ist kontrolliert.

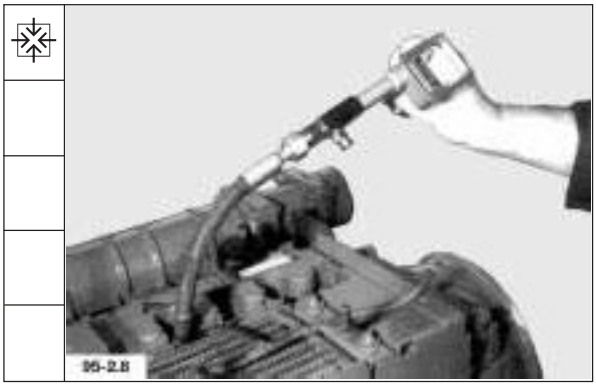
1. Anschlußstück mit neuer Spezialdichtung einsetzen.



2. Spannpratze aufsetzen. Schraube festdrehen.



3. Falls notwendig Adapter für Anschlußstück aufschrauben.



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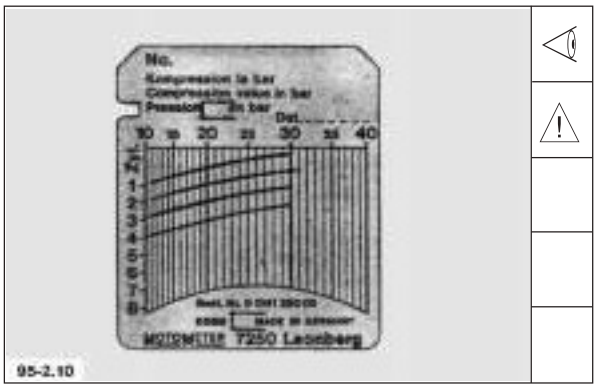


Deutsch

4. Kompressionsdruckprüfer anschließen.
   Motor mit Starter durchdrehen.
   Kompressionsdruck:

F 1011 F	**25-30 bar**
BF 1011 F	**22-27 bar**

Der gemessene Kompressionsdruck ist abhängig von der Anlaßdrehzahl während des Meßvorganges und der Höhenlage des Motoraufstellortes.
Grenzwerte sind daher nicht genau festlegbar. Empfohlen wird die Kompressionsdruckmessung nur als Vergleichsmessung aller Zylinder eines Motors untereinander anzusehen. Sind mehr als **15%** Abweichung ermittelt worden, sollte durch die Demontage der betroffenen Zylindereinheit die Ursache ermittelt werden.

Hinweis: Einspritzventil mit neuer Spezialdichtung einsetzen und festdrehen.

Anziehvorschrift: **21 Nm**

Einspritzleitungen festdrehen.

Anziehvorschrift: **22 + 2 Nm**

Die Leckölleitung ist grundsätzlich zu erneuern.

English

4. Connect compression tester. Turn engine with starter.
   Compression pressure:
   F engine **25-30 bar**
   BF engine **22-27 bar**

The measured compression pressure is dependent on the starting speed during the measuring process and also on the altitude of the engine site. Therefore it is difficult to specify precise limit values. It is recommended to use the compression pressure measurement only for comparison of compression pressures of all cylinders in one engine. If a difference in pressure in excess of **15 %** is determined, the cylinder unit concerned should be dismantled to establish the cause.

Note: Fit injector with new special seal and tighten.

Tightening specification: **21 Nm**

Tighten injection lines.

Tightening specification: **22 + 2 Nm**

The leakage fuel line must always be renewed.

Français

4. Brancher le compressiomètre. Virer le moteur au démarreur
   Pression de compression
   Moteur F **25-30 bars**
   Moteur BF **22-27 bars**

Le taux de compression mesuré dépend de la vitesse de démarrage durant le relevé des mesures, et de l'altitude du lieu d'implantation du moteur.
Des valeurs limites précises ne peuvent donc pas être fixées. Il est conseillé de considérer la mesure du taux de compression uniquement comme mesure comparative pour tous les cylindres d'un moteur. En cas d'écart supérieur à **15 %**, la cause pourra être déterminée en démontant l'unité cylindre concernée.

Nota: monter l'injecteur avec un joint spécial et serrer.

Consigne de serrage: **21 Nm.**

Serrer les tuyauteries d'injection.

Consigne de serrage **22 + 2 Nm**.

Toujours remplacer la tubulure de retour de fuites.

Español

4. Conectar el compresímetro. Girar el motor con ayuda del arrancador.
   Presión de compresión:
   Motor F **25 - 30 bar**
   Motor BF **22 - 27 bar**

El valor de compresión medido depende de la velocidad de arranque durante la medición y de la altitud del lugar de instalación del motor.
Por tanto, no es posible fijar valores límite exactos. La medición de compresión se aconseja solamente como una medida de comparación entre todos los cilindros de un mismo motor. Si se verifican diferencias superiores al **15%**, es conveniente buscar la causa, desmontando la unidad de cilindro afectada.

Nota: Montar el inyector con una junta especial nueva y apretar.

Prescripción de apriete: **21 Nm**.

Apretar las tuberías de inyección.

Prescripción de apriete: **22 + 2 Nm**.

La tubería de combustible sobrante deberá ser sustituida, en todos los casos, por otra nueva.

English

Commercial tools required:

Nozzle tester _____ 8008
Long socket a/flats 15 _____ 8021

Special tool required:

Retainer for injector _____ 110 110

Note: Utmost cleanliness must be ensured when working on the injection equipment. For testing the injector use only pure test oil to ISO 4113 or clean diesel fuel.

Caution!

Beware of injection nozzle fuel jet. The fuel penetrates deeply into the skin tissue and may cause blood poisening.

1. Connect injector to nozzle tester.

2. Checking opening pressure

With pressure gauge switched on, slowly press down lever of nozzle tester. The pressure at which the gauge pointer stops or suddenly drops, is the opening pressure.

Opening pressure for initial setting:
Genset engines = **250 + 8 bar**
Automotive engines = **210 + 8 bar**

Français

Outillage usuel:

Banc d'essais d'injecteurs _____ 8008
Clé à douille longue de 15 _____ 8021

Outillage spécial:

Dispositif d'immobilisation pour injecteur _____ 110 110

Nota: tous les travaux à effectuer sur les injecteurs doivent être réalisés dans de parfaites conditions de propreté. Pour contrôler les injecteurs n'utiliser que du gazole d'essai pur selon ISO 4113 ou du combustible diesel parfaitement propre.

Attention!

Tenir les mains à l'écart des jets de gazole, la force de pénétration de ceux-ci est telle qu'ils peuvent créer des blessures graves et amener un empoisonnement du sang.

1. Monter l'injecteur sur la pompe d'essais d'injecteurs.

2. Contrôle de la pression d'ouverture

Le manomètre étant branché, appuyer lentement sur le levier de la pompe d'essai d'injecteurs. La pression à laquelle l'aiguille s'arrête ou chute brusquement, est la pression maxi ou pression d'ouverture.
Valeur de contrôle de pression d'ouverture pour nouveau tarage :
Moteurs de groupe: **250 + 8 bars**
Moteurs de véhicule: **210 + 8 bars**

Español

Herramientas comerciales:

Comprobador para inyectores __ 8008
Llave de vaso largo de 15 _____ 8021

Herramientas especiales:

Soporte de inyectores _____ 110 110

Nota: Al trabajar en el equipo de inyección, se deberá observar máxima limpieza. Para la prueba de los inyectores sólo se utilizará aceite de ensayo puro según ISO 4113 o combustible diesel limpio.

Atención:

No acercar nunca las manos a los chorros del inyector, pues el combustible se introduce en la carne y destruye los tejidos. Si llega a la sangre, produce grave intoxicación.

1. Empalmar el inyector al comprobador.

2. Comprobación de la presión de apertura

Con el manómetro conectado, empujar la palanca del comprobador lentamente hacia abajo. La presión a la que la aguja se detiene o cae repentinamente, es la presión de apertura.
Presión de apertura para el nuevo ajuste en motores:
para grupos electrógenos = **250 + 8 bar**.
para vehículos = **210 + 8 bar**.

Deutsch

Handelsübliche Werkzeuge:

Düsenprüfgerät _____ 8008
Lange Stecknuß SW 15 _____ 8021

Spezialwerkzeug:

Halter für Einspritzventil _____ 110 110

Hinweis: Bei Arbeiten an der Einspritzausrüstung auf größte Sauberkeit achten. Zur Prüfung der Einspritzventile nur reines Prüföl nach ISO 4113 oder sauberen Dieselkraftstoff verwenden.

Achtung !

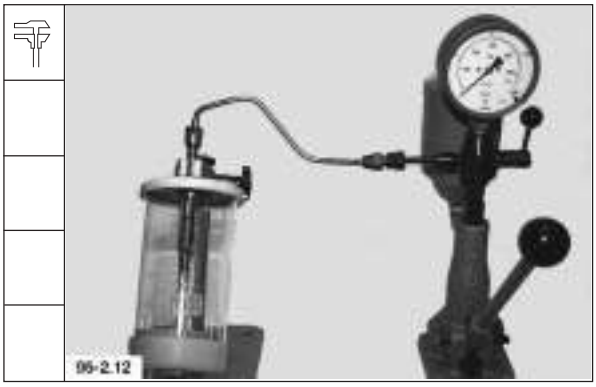
Hände weg vom Düsenstrahl. Der Kraftstoff dringt tief in das Fleisch ein und kann zur Blutvergiftung führen.

1. Einspritzventil an das Düsenprüfgerät anbauen.

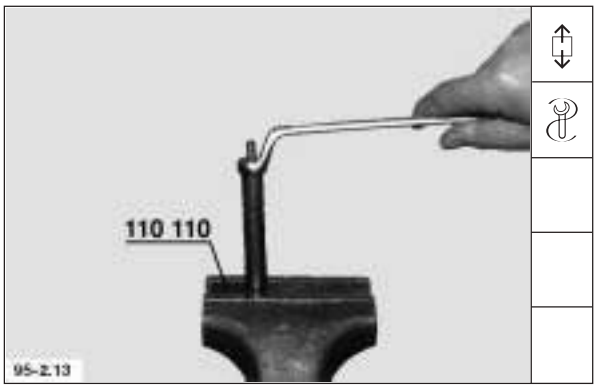
2. Prüfung des Öffnungsdruckes

Hebel des Düsenprüfgerätes bei zugeschaltetem Manometer langsam niederdrücken. Der Druck bei dem der Zeiger stehen bleibt oder plötzlich abfällt, ist der Öffungsdruck.

Öffnungsdruck für die Neueinstellung:
Aggregat - Motoren = **250 + 8 bar**
Fahrzeug - Motoren = **210 + 8 bar**

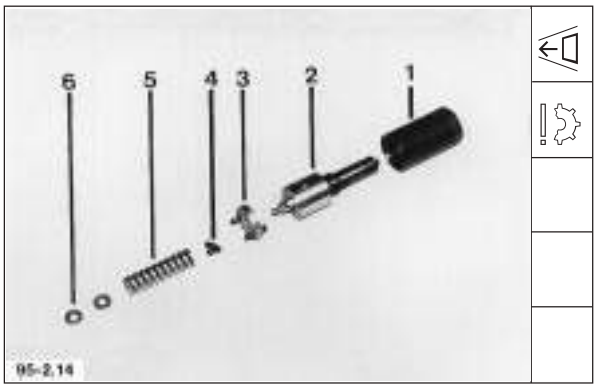


Deutsch



3. Einstellen des Öffnungsdruckes am Einspritzventil

Überwurfmutter abschrauben, alle Teile ausbauen.



Folge der Einzeldemontage

1. Überwurfmutter
2. Einspritzdüse
3. Zwischenstück
4. Druckbolzen
5. Druckfeder
6. Ausgleichscheiben

4. Durch Auswahl der erforderlichen Scheibe Druck einstellen. Stärkere Scheibe ergibt höheren Öffnungsdruck. Einspritzventil zusammenbauen. Überwurfmutter festdrehen.

   Anziehvorschrift: **45 ± 5 Nm**

   Einspritzventil auf dem Düsenprüfgerät erneut prüfen.

5. **Prüfung auf Dichtheit**

   Düse und Düsenhalter abtrocknen - mit Luft trockenblasen. Handhebel des Prüfgerätes langsam niederdrücken, bis ca. **20 bar** unterhalb des vorher abgelesenen Öffnungsdruckes erreicht werden.

English

3. Adjusting the opening pressure on the injector

Unscrew cap nut and remove all parts

Sequence of parts disassembly

1. Cap nut
2. Injection nozzle
3. Adapter
4. Thrust pin
5. Compression spring
6. Shims

4. Adjust pressure by selecting appropriate shim. A thicker shim increases the opening pressure. Reassemble injector. Tighten cap nut.

Tightening specification: **45 ± 5 Nm**

Recheck injector on nozzle tester.

5. Checking for tightness

Dry nozzle and nozzle holder - blow out with compressed air. Press down handlever of nozzle tester slowly until a pressure of about **20 bar** below the previous opening pressure reading is attained.

Français

3. Tarage de la pression d'ouverture sur injecteur

Dévisser l'écrou-raccord et déposer toutes les pièces.

Suite du démontage des pièces

1. Ecrou-raccord
2. Injecteur
3. Pièce intermédiaire
4. Tige poussoir
5. Ressort de pression
6. Rondelles d'épaisseur

4. Régler la pression en prenant le nombre de rondelles nécessaires. Des rondelles plus épaisses entraînent une pression d'ouverture plus grande. Remonter l'injecteur et serrer l'écrou-raccord.

Consigne de serrage: **45 ± 5 Nm**

Contrôler à nouveau l'injecteur à l'aide de la pompe d'essai d'injecteurs.

5. Contrôle de l'étanchéité

Sécher l'injecteur et le porte-injecteur par jet d'air. Appuyer lentement sur le levier de la pompe d'essai jusqu'à obtention d'environ **20 bars** en-dessous de la pression d'ouverture lue auparavant.

Español

3. Ajuste de la presión de apertura en el inyector

Desenroscar la tuerca de unión y desmontar todas las piezas.

Secuencia del despiece

1. Tuerca de unión
2. Inyector propiamente dicho
3. Pieza intermedia
4. Perno de presión
5. Muelle de presión
6. Arandelas de reglaje

4. Ajustar la presión eligiendo la arandela adecuada. Una arandela más gruesa da una presión de apertura más elevada. Rearmar el inyector. Apretar la tuerca de unión.

Prescripción de apriete: **40 ± 5 Nm**.

Volver a ensayar el inyector sobre el comprobador.

5. Comprobación de estanqueidad

Secar el inyector y el portainyector, soplándolos con aire comprimido. Empujar la palanca de mano del comprobador lentamente hacia abajo hasta alcanzar un valor de aprox. **20 bar** por debajo de la presión de apertura leída previamente.

English

6. Nozzle is tight if there is no dripping within a period of **10** seconds.

7. In case of a drip, the injector must be dismantled and cleaned to remedy the leak. If this does not cure the leak, the injector must be replaced.

   Reworking is not permissible.

8. Buzzing and spray pattern test

Switch off pressure gauge of tester.

The buzzing test permits an audible check of the ease of movement of the nozzle needle in the nozzle body. New injectors emit a different buzzing sound as compared to used injectors. It deteriorates due to wear in the needle seat area. If an injection nozzle does not buzz despite cleaning, it must be renewed.

A used injector should buzz clearly during rapid actuation of the handlever, while exhibiting a well atomized spray pattern. The spray pattern may differ noticeably from that of a new injector.

Français

6. L'injecteur est étanche lorsqu'il ne goutte plus durant **10** secondes.

7. Si l'injecteur goutte, le déposer et le nettoyer pour supprimer le manque d'étanchéité. En cas d'échec, remplacer l'injecteur.

   Ne jamais rectifier l'injecteur.

8. Contrôle du crissement caractéristique de l'injecteur

Débrancher le manomètre de la pompe d'essai.

Le contrôle du crissement permet un contrôle audible de l'injecteur dont l'aiguille doit retomber d'elle-même dans son logement. Les injecteurs neufs présentent par rapport aux injecteurs usagés un crissement différent. L'usure se produisant au niveau du siège de l'aiguille entraîne une dégradation du crissement. Si, après nettoyage, l'injecteur refuse de crisser, il faut le remplacer.

Un injecteur usagé doit, après actionnement rapide du levier de commande, émettre un crissement audible et pulvériser de manière bien homogène. La forme du jet peut alors, à la différence d'un injecteur neuf, être tout à fait différente.

Español

6. El inyector es estanco si, pasados **10** segundos, no sale ni una gota de líquido.

7. Si cae una gota, el inyector debe ser desarmado y limpiado para eliminar la falta de estanqueidad. Si esto no surte efecto, es necesario reemplazar el inyector.

   No están permitidos trabajos de repaso.

8. Comprobación del ronquido y chorro

Desconectar el manómetro del comprobador.

La comprobación del ronquido permite controlar acústicamente la facilidad de movimiento de la aguja dentro del cuerpo del inyector. Inyectores nuevos tienen un ronquido diferente de los usados. El desgaste en la zona de asiento de la aguja lo empeora. Si el inyector no produce el ronquido característico del mismo a pesar de su limpieza anterior, es necesario sustituirlo por otro nuevo.

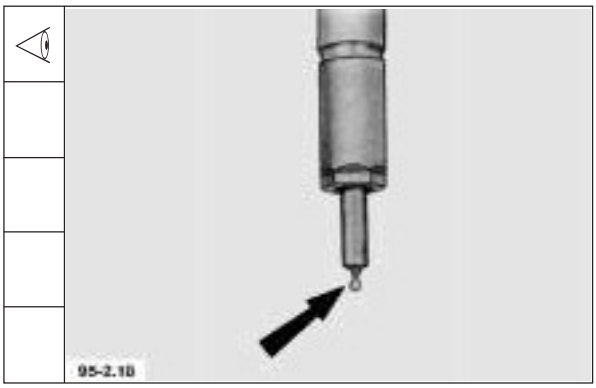
Un inyector usado tiene que roncar de forma audible y producir un chorro bien pulverizado si se acciona la palanca rápidamente. La forma del chorro puede diferir, en tal caso, claramente de la producida por un inyector nuevo.

Deutsch

6. Düse ist dicht, wenn innerhalb **10** Sekunden kein Tropfen abfällt.

7. Fällt ein Tropfen ab, ist das Einspritzventil zu zerlegen und die Undichtigkeit durch Reinigen zu beseitigen. Ist das nicht erfolgreich, muß die Einspritzdüse erneuert werden.

   Nacharbeit ist nicht zulässig.

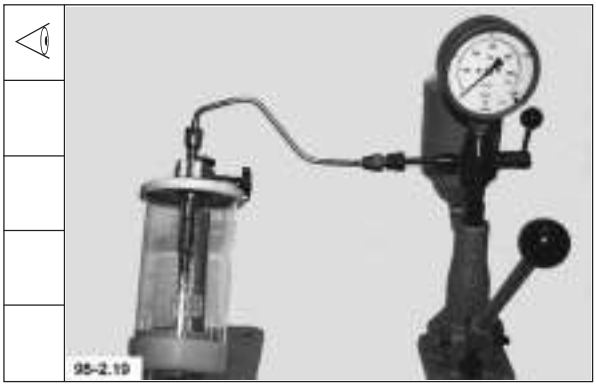


8. Schnarr- und Strahlprüfung

Manometer des Prüfgerätes abschalten.

Die Schnarrprüfung ermöglicht eine hörbare Prüfung der Leichtgängigkeit der Düsennadel im Düsenkörper. Neue Einspritzventile haben gegenüber gebrauchten ein geändertes Schnarrverhalten.
Durch Verschleiß im Nadelsitzbereich verschlechtert es sich. Schnarrt eine Einspritzdüse trotz Reinigung nicht, muß sie durch eine neue ersetzt werden.

Ein gebrauchtes Einspritzventil muß bei schneller Hebeltätigkeit hörbar schnarren und dabei gut zerstäubt abspritzen. Das Strahlbild kann dabei gegenüber dem eines neuen Einspritzventils deutlich unterschiedlich sein.



English

Commercial tool required:
Injection pump tester_____ 8006

Special tool required:
Special wrench
for injection line_____ 110 490

The following inspection for injection pumps with parts no 0417 9573 and 0417 9981 (with con-stant pressure valve).

The injection pump is tested on the engine to make sure that the delivery valve and pump element are not leaking. For the test, it is essential that the fuel feed system is operating properly and that there is no air in the fuel system.

Injection lines have been removed.

1. Connect injection pump tester to delivery valve holder.

2. Turn crankshaft via V-belt pulley, while bleeding tester at the screw plug.

3. Turn crankshaft until a pressure of **150 bar** is applied to the delivery valve. The pressure may drop by **10 bar** within one minute.

Français

Outillage usuel:
Appareil de contrôle de la pompe d'injection _____ 8006

Outillage spécial:
Clé spéciale pour
conduite d'injection _____ 110490

Dans le cas des pompes à injection portant le numéro de pièce 0417 9573 et 0417 9981 (avec soupape de pression constante), il est impossible d'effecteur le contrôle décrit ciaprès.

Le contrôle de la pompe d'injection se fait sur le moteur même au niveau de l'étanchéité de la soupape de refoulement et de l'élément de pompe. Ce contrôle suppose une alimentation en combustible irréprochable et l'absence d'air dans le système d'injection.

Les conduites d'injection sont déposées.

1. Raccorder l'appareil de contrôle de la pompe d'injection au support de la soupape de refoulement.

2. Virer le vilebrequin par la poulie à gorge et purger l'appareil de contrôle par le bouchon obturateur.

3. Virer le vilebrequin jusqu'à obtention d'une pression de **150 bars** à la soupape de refoulement. Cette pression peut tomber de **10 bars** en l'espace d'une minute.

Español

Herramienta comercial:
Comprobador de bombas
de inyección _____ 8006

Herramienta especial:
Llave especial para
tuberías de inyección _____ 110 490

Si se tatra de bombas de inyección con el N° de pieza 0417 9573 y 0417 9981 (con válvula de presión constante) no es posible llevar a cabo la siguiente prueba.

La bomba de inyección es ensayada sobre el motor en cuanto a estanqueidad de la válvula de presión y del elemento de bomba. Condición previa para la comprobación es que el abastecimiento del combustible sea impecable y no exista aire en el sistema de combustible.

Las tuberías de inyección están desmontadas.

1. Conectar el comprobador de bombas de inyección al soporte de la válvula de presión.

2. Girar el cigüeñal a través de la polea de correa trapezoidal, purgando de aire el comprobador en el tapón roscado.

3. Girar el cigüeñal hasta que la válvula de presión cuente con una presión de **150 bar,** admitiéndose una caída de presión de **10 bar** dentro de un minuto.

Deutsch

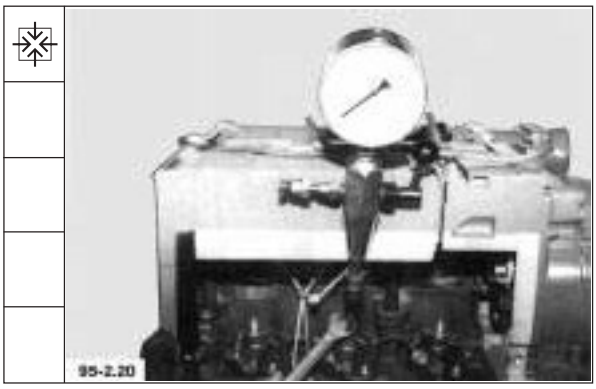
Handelsübliches Werkzeug:
Einspritzpumpenprüfgerät _____ 8006

Spezialwerkzeug:
Spezialschlüssel für Einspritzleitung __ 110 490

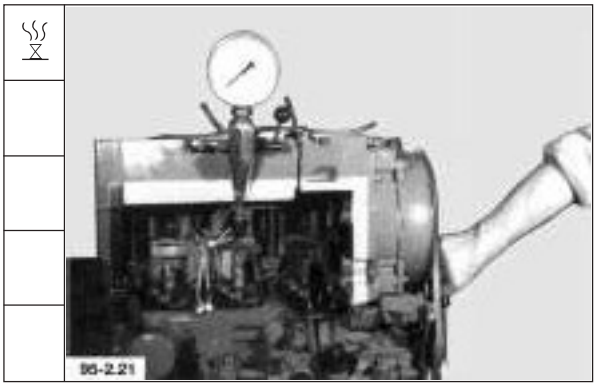
Bei Einspritzpumpen mit Teile-Nr. 0417 9573 und 0417 9981 (mit Gleichdruckventil) ist folgende Prüfung nicht möglich.
Die Einspritzpumpe wird am Motor auf Dichtheit des Druckventils und Pumpenelementes geprüft. Voraussetzung für die Prüfung ist einwandfreie Kraftstoffversorgung und keine Luft im Kraftstoffsystem.

Einspritzleitungen sind abgebaut.

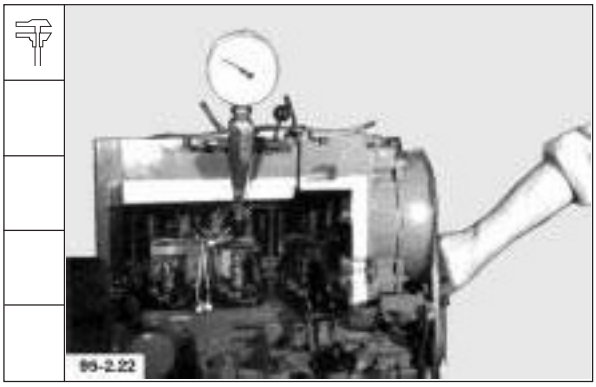
1. Einspritzpumpenprüfgerät am Druckventilhalter anschließen.



2. Kurbelwelle über die Keilriemenscheibe durchdrehen, dabei das Prüfgerät an dem Verschlußstopfen entlüften.



3. Kurbelwelle durchdrehen, bis das Druckventil mit einem Druck von **150 bar** beaufschlagt ist. Der Druck darf in einer Minute um **10 bar** abfallen.



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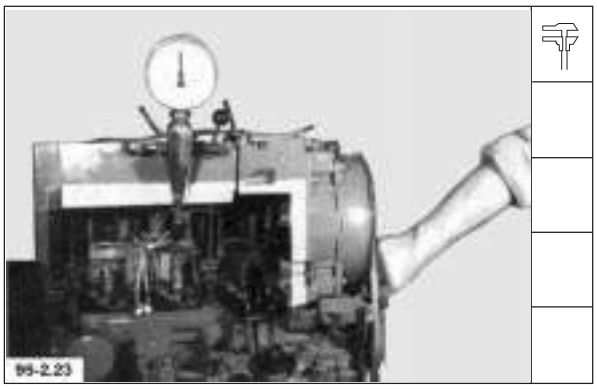
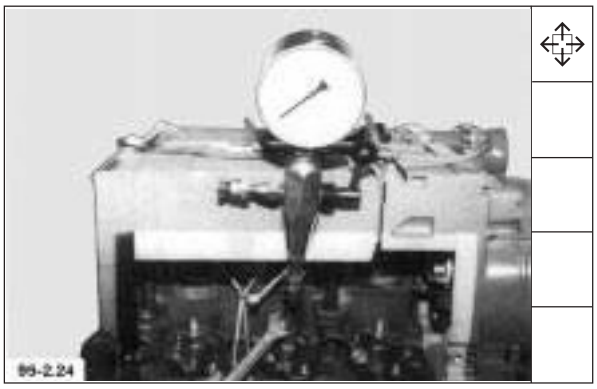
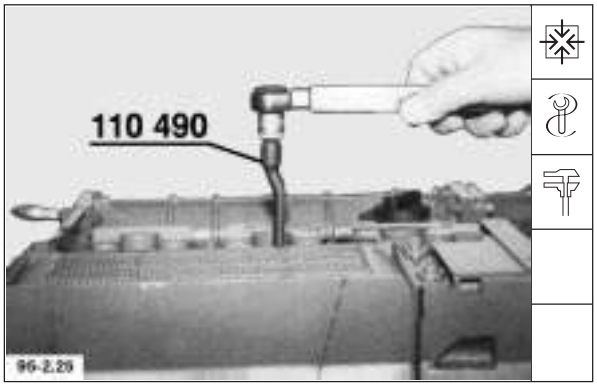
Deutsch



4. Kurbelwelle um 5 Umdrehungen weiter durchdrehen, dabei müssen **300 bar** erreicht werden. Ist der Sollwert nicht erreichbar, Einspritzpumpe austauschen.

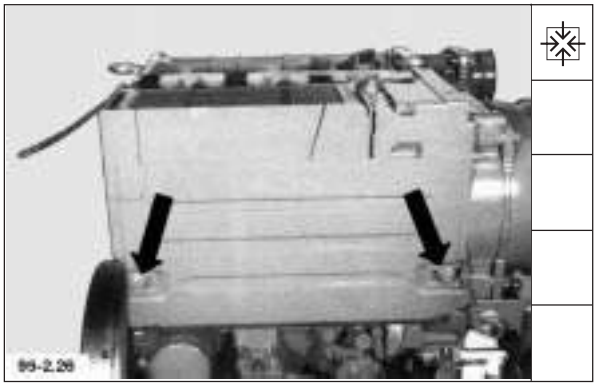


5. Einspritzpumpenprüfgerät abbauen.



6. Einspritzleitungen anbauen und festdrehen.

   Anziehvorschrift: **22 + 2 Nm**



7. Luftführungshaube anbauen. Schrauben festdrehen.

English

4. Turn crankshaft further by 5 revolutions until a pressure of **300 bar** is attained. If the specified value cannot be reached, replace the injection pump.

5. Remove injection pump tester.

6. Fit injection lines and tighten.

   Tightening specification: **22 + 2 Nm**

7. Fit air cowling. Tighten bolts.

Français

4. Continuer à virer le vilebrequin de 5 tours jusqu'à obtention de **300 bars.** Si cette valeur de consigne ne peut pas être atteinte, remplacer la pompe d'injection.

5. Démonter l'appareil de contrôle de la pompe d'injection.

6. Monter les conduites d'injection et serrer.

   Consigne de serrage **22 + 2 Nm.**

7. Monter la hotte de guidage d'air puis serrer les vis.

Español

4. Seguir girando el cigüeñal unas 5 vueltas más, debiéndose alcanzar **300** bar. Si no se puede alcanzar el valor prescrito, hay que sustituir la bomba de inyección por otra nueva.

5. Desmontar el comprobador de bombas de inyección.

6. Montar las tuberías de inyección y apretar.

   Prescripción de apriete: **22 + 2 Nm**

7. Montar la manga guía de aire. Apretar los tornillos.

Bauteile instand setzen

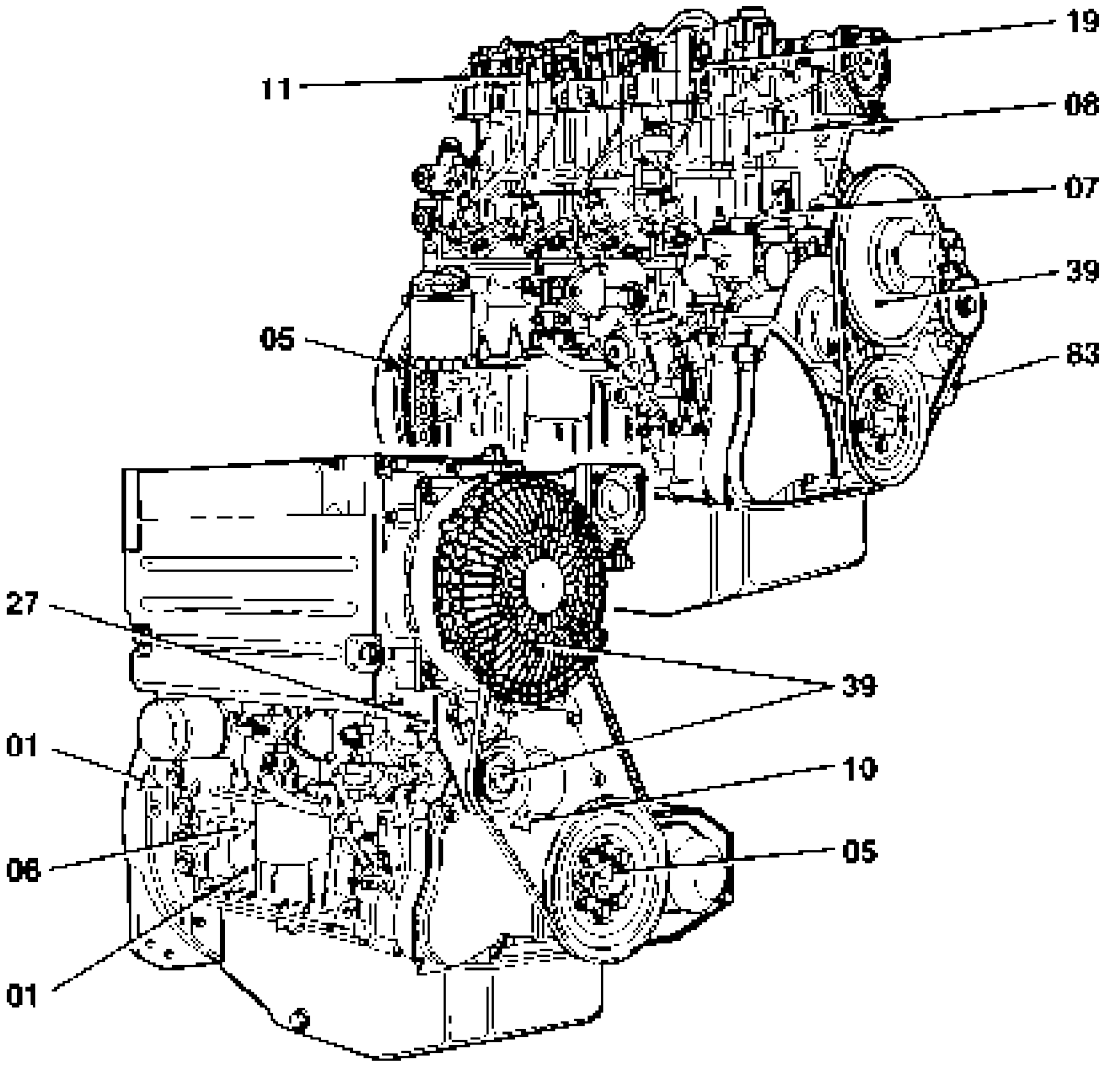
Repair of components

Mise en état des composants

Reparación de componentes

1011 F

DEUTZ


19
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Deutsch

3. Bauteile instand setzen

English

3. Repair of components

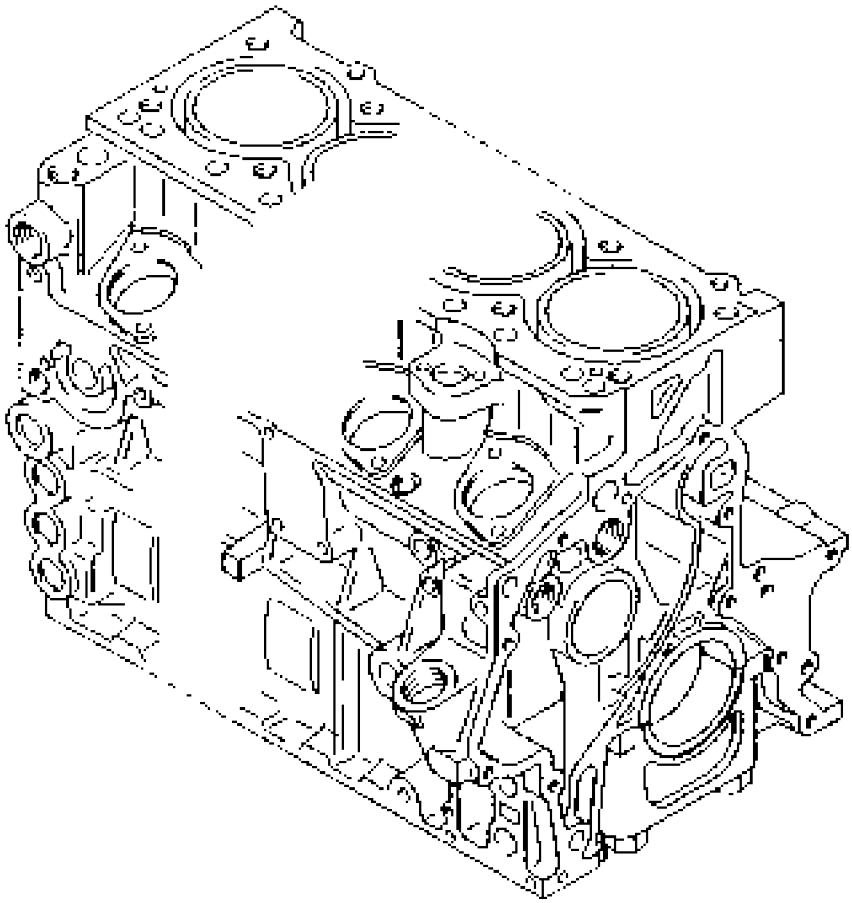
Werkstatthandbuch 1011 F

Français

3. Mise en état des composants

Español

3. Reparación de componentes



English

Commercial tools required:
Screw driver socket _____ 8112
Internal dial gauge

Special tools required:
Assembly tool for control rod bush _____ 110 140
Assembly tool for camshaft bush _____ 143 820
Puller for pipe _____ 150 140
Assembly arbor for pipe ___ 150 150

1. Clean crankcase and inspect for damage.

Note: Prior to measurement tighten main bearing caps as specified.

Tightening specification:
Initial tightening torque **50 Nm**
1st tightening angle **60°**
2nd tightening angle **45°**

2. Set internal dial gauge to 91 mm.

3. Gauge cylinders.

Cylinder bore: **91** $^{+0.02}$ **mm**
Wear limit: **91.1 mm**

Français

Outillage usuel:
Embout de tournevis _____ 8112
Appareil de mesure

Outillage spécial:
Outil de montage pour douille de crémaillère _____ 110 140
Outil de montage pour bague d'arbre à cames ____ 143 820
Extracteur de tube _____ 150 140
Mandrin de montage pour tube _____ 150 150

1. Nettoyer le bloc moteur et contrôler visuellement s'il ne présente pas de détérioration.

Nota: avant de procéder au relevé des mesures serrer les chapeaux de paliers de vilebrequin selon les préconisations de serrage.

Consigne de serrage:
Valeur de préserrage: **50 Nm**
Valeur de serrage à l'angle: 1re phase: **60°**
2e phase: **45°**

2. Régler l'appareil de mesure à 91 mm.

3. Effectuer un relevé des cotes du cylindre

Alésage du cylindre: **91** $^{+0,02}$ **mm**
Limite d'usure: **91,1 mm**

Español

Herramientas comerciales:
Punta recambiable de destornillador _____ 8112
Micrómetro de interiores

Herramientas especiales:
Herramienta de montaje para manguitos de cremallera ___ 110 140
Herramienta de montaje para casquillos de árbol de levas _ 143 820
Extractor para tubos _____ 150 140
Mandril de montaje para tubos _____ 150 150

1. Limpiar el bloque motor y examinarlo visualmente en cuanto a daños.

Nota: Antes de proceder a la medición es necesario apretar las tapas de los cojinetes del cigüeñal según prescripción.

Prescripción de apriete:
Apriete inicial **50 Nm**
Reapriete1ª fase **60°**
2ª fase **45°**

2. Ajustar el micrómetro de interiores a 91 mm.

3. Medir los cilindros -

calibre de cilindro: **91** $^{+0,02}$ **mm**
límite de desgaste: **91,1 mm**

Deutsch

Handelsübliche Werkzeuge:

Schraubendrehereinsatz	8112
Innenmeßgerät	

Spezialwerkzeuge:

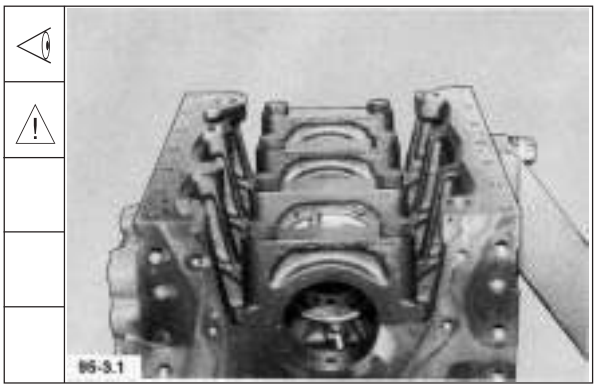
Montagewerkzeug für Regelstangenbuchse	110 140
Montagewerkzeug für Nockenwellenbuchse	143 820
Ausziehwerkzeug für Rohr	150 140
Montagedorn für Rohr	150 150

1. Kurbelgehäuse reinigen und auf Beschädigung sichtprüfen.

Hinweis: Vor der Messung sind die Kurbelwellenlagerdeckel nach Anziehvorschrift festzudrehen.

Anziehvorschrift:

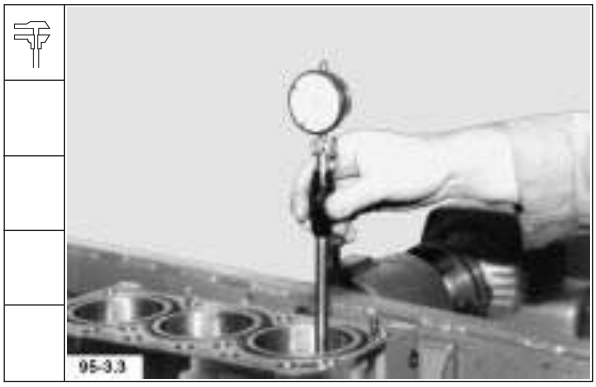
Vorspannwert		**50 Nm**
Nachspannwinkel	1. Stufe	**60°**
	2. Stufe	**45°**



2. Innenmeßgerät auf 91 mm einstellen.

3. Zylinder messen-

Zylinderbohrung:	**91** $^{+0,02}$ **mm**
Verschleißgrenze:	**91,1 mm**



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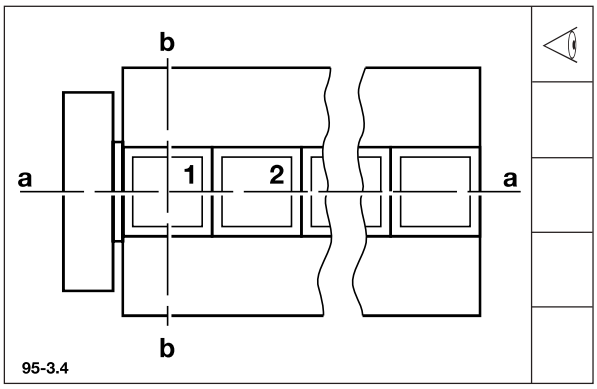
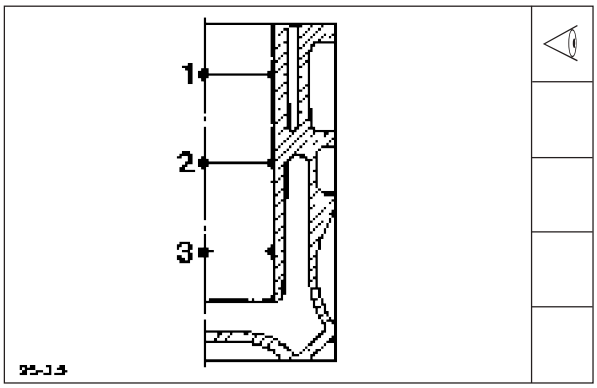
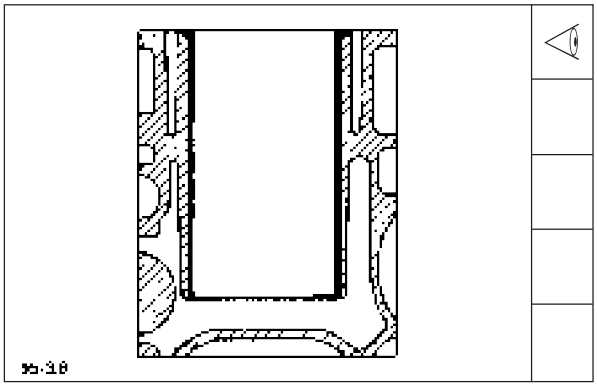
Deutsch



3.1 - in der Motorlängsachse „a“ und Motorquer-achse „b“



3.2 - und in der Ebene 1-3.



4. Bei verschlissener Zylinderlaufbahn besteht die Möglichkeit in unseren Service-Centern ein aufgebohrtes mit neuen Laufbuchsen (Slipfit-Buchsen) ausgerüstetes Zylinderkurbelgehäuse zu beziehen.

5. Bei Vorhandensein der Slipfit-Buchsen im Zylinderkurbelgehäuse

   -Slipfit-Buchsen herausziehen.

English	Français	Español
3.1 - in the engine's longitudinal axis „a“ and transverse axis „b“	3.1. dans l'axe longitudinal „a“ et dans l'axe transversal „b“	3.1 - en los ejes longitudinal „a““ y transversal „b“ del motor.
3.2 - and in planes 1-3.	3.2 et sur le plan 1-3.	3.2 - y en los planos 1-3.
4. If the cylinder working surfaces are worn out, it is possible to obtain from our Service Centers a rebored crankcase with new liners (slip fit liners).	4. Lorsque la surface de frottement du cylindre est usée, il est possible de se procurer, en s'adressant à nos Service Centers, un bloc moteur alésé avec chemises neuves (chemises dites slipfit).	4. Si la superficie de roce del cilindro está desgastada, existe la posibilidad de aquirir, en nuestros Centros de Servicio, un bloque motor con los cilindros mandrinados y equipados con nuevas camisas (slipfit).
5. If slip fit liners are installed, pull them out.	5. En présence de chemises slipfit dans le bloc moteur - retirer ces dernières.	5. Si el bloque de cilindros lleva camisas slipfit, - sacar estas camisas.

English

6. Inspect receiving bores and liner seating surface.

7. Press in new slip fit liners as far as they will go.

Note: To be used only with new standard pistons.

If the measured data correspond to the values specified for the liners, the crankcase may be repaired as necessary.

8. Remove screw plugs. Check oil ducts for free passage.

Français

6. Contrôle visuel des alésages de positionnement et de la collerette d'appui.

7. Enfoncer les chemises neuves slipfit jusqu'en position de butée.

Nota: utilisation prévue uniquement avec des pistons de série.

Si le relevé des cotes des chemises correspond aux valeurs indiquées, au besoin remettre en état le bloc moteur.

8. Dévisser les vis filetées. Vérifier si les canalisations d'huile ne sont pas obstruées.

Español

6. Examinar visualmente los alojamientos de las camisas y el asiento para el reborde de las mismas.

7. Introducir a presión, hasta el tope, las camisas slipfit nuevas.

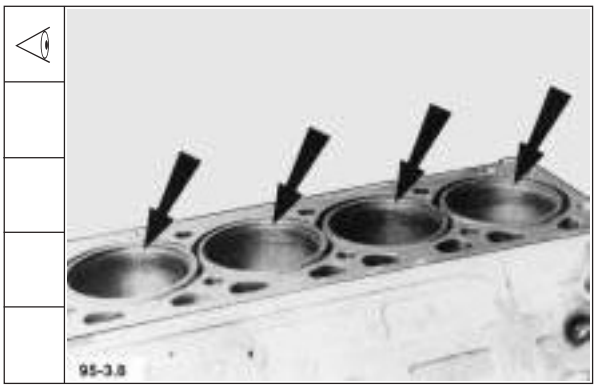
Nota: Se admite su uso tan sólo en conjunto con los pistones nuevos de serie.

Si los valores medidos de las camisas corresponden a los especificados, se reacondicionará el bloque de cilindros en la medida necesaria.

8. Desenroscar los tapones de cierre. Comprobar si los conductos de aceite están despejados.

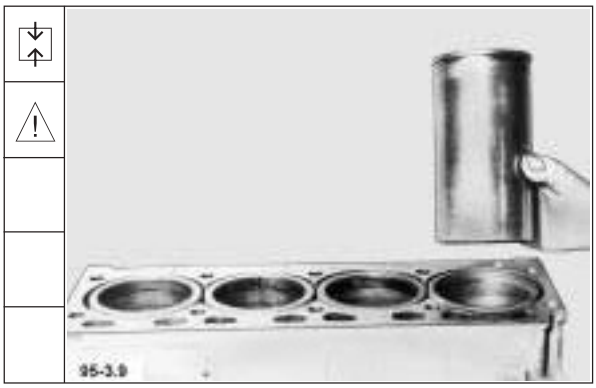
Deutsch

6. Aufnahmebohrungen und Bundauflage sichtprüfen.



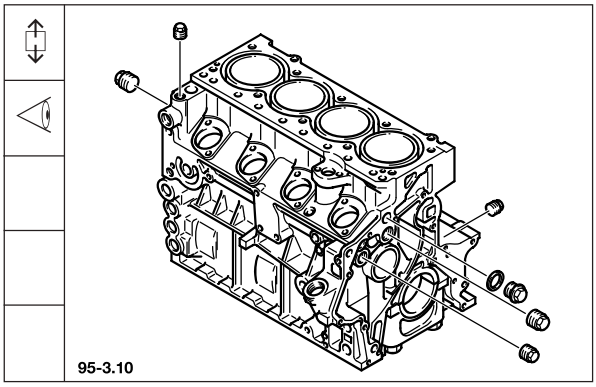
7. Neue Slipfit-Buchsen bis Anlage eindrücken.

Hinweis: Verwendung nur mit neuen Serienkolben.



Entsprechen die Messungen der Laufbuchsen den angegebenen Werten, ist nach Bedarf das Zylinderkurbelgehäuse instandzusetzen.

8. Verschlußschrauben herausschrauben. Ölkanäle auf freien Durchlaß prüfen.



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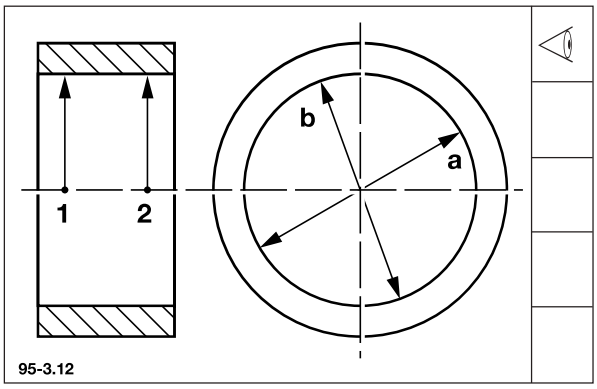
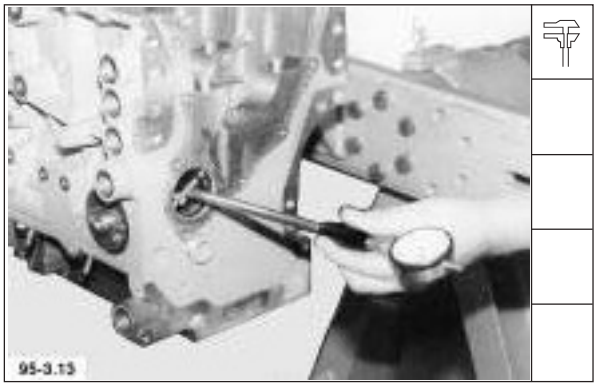
Deutsch

Nockenwellenlagerbuchsen

9. Innenmeßgerät auf **54 mm** einstellen.



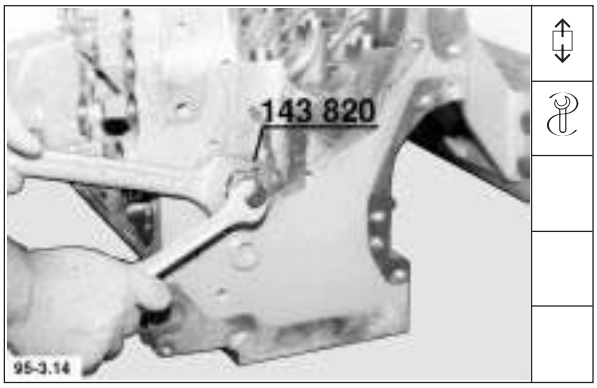
10. Schema zum Vermessen der Lagerbuchsen an den Punkten 1 und 2 in der Ebene "a" und "b".



11. Lagerbuchsen messen, ggf. auswechseln.

Nockenwellenlagerbuchse

Innendurchmesser:	**54** $^{+0,054}$	**mm**
Verschleißgrenze:	**54,080**	**mm**



12. Lagerbuchsen ausbauen.

English

Camshaft bearing bushes

9. Set internal dial gauge to **54 mm.**

10. Schematic for gauging the bearing bushes at points 1 and 2 in planes „a“ and „b“.

11. Gauge bearing bushes, renew if necessary.

Camshaft bearing bush

Inner diameter:	**54** $^{+0.054}$ **mm**
Wear limit:^	**54.080 mm**

12. Remove bearing bushes.

Français

Bagues de paliers d’arbre à cames

9. Régler l’appareil de mesure à **54 mm.**

10. Schéma de relevé des mesures des bagues de paliers aux points 1 et 2 dans l’axe „a“ et „b“.

11. Faire un relevé des cotes des bagues de palier, les remplacer le cas échéant.

Bague de palier d’arbre à cames

Diamètre intérieur:	**54** $^{+0,054}$ **mm**
Limite d’usure:	**54,080 mm**

12. Déposer les bagues de palier.

Español

Casquillos del árbol de levas

9. Ajustar el micrómetro de interiores a **54 mm.**

10. Esquema para efectuar la medición de los casquillos de soporte en los puntos 1 y 2 de los planos „a“ y „b„.

11. Verificar las medidas de los casquillos, sustituyéndolos en caso necesario.

Casquillo del árbol de levas

Diámetro interior:	**54** $^{+0,054}$ **mm**
Límite de desgaste:	**54,080 mm**

12. Desmontar los casquillos.

English

13. Schematic: Installation dimensions of bearing bushes.

	A	B
2-Cyl.	2.5 mm 117.1 mm	0.5 mm
3-Cyl.	2.5 mm 118.9 mm	0.5 mm 117.1 mm
4-Cyl.	2.5 mm 118.9 mm	0.5 mm 117.1 mm 228.1 mm

14. Schematic: Installation direction of joint in the bearing bush.

15. Position new bearing bush.

Note: Lube oil bores must be lined up.

16. Insert bearing bush.

Français

13. Schéma: cotes d'insertion des bagues de paliers.

	A	B
2 cyl.	2,5 mm 117,1 mm	0,5 mm
3 cyl	2,5 mm 118,9 mm	0,5 mm 117,1 mm
4 cyl.	2,5 mm 118,9 mm	0,5 mm 117,1 mm 228,1 mm

14. Schéma: sens de montage du joint de la bague de palier.

15. Placer une nouvelle bague de palier.

Nota: veiller à ce que les trous de graissage correspondent.

16. Introduire la bague de palier.

Español

13. Esquema: Medidas de introducción de los casquillos.

	A	B
2 cil.	2,5 mm 117,1 mm	0,5 mm
3 cil.	2,5 mm 118,9 mm	0,5 mm 117,1 mm
4 cil.	2,5 mm 118,9 mm	0,5 mm 117,1 mm 228,1 mm

14. Esquema: dirección de montaje de la junta de tope del casquillo.

15. Posicionar el casquillo nuevo.

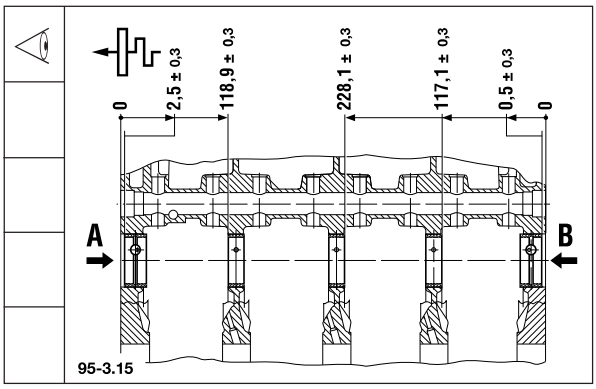
Nota: Prestar atención a la coincidencia de los orificios de lubricación.

16. Introducir el casquillo.

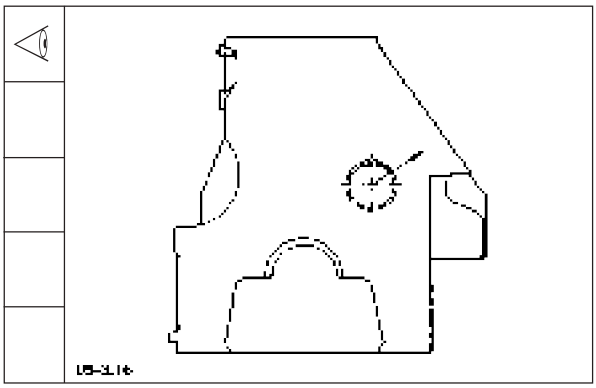
Deutsch

13. Schema: Einziehmaße der Lagerbuchsen.

	A	B
2 Zyl.	2,5 mm	0,5 mm
		117,1 mm
3 Zyl.	2,5 mm	0,5 mm
	118,9 mm	117,1 mm
4 Zyl.	2,5 mm	0,5 mm
	118,9 mm	117,1 mm
		228,1 mm

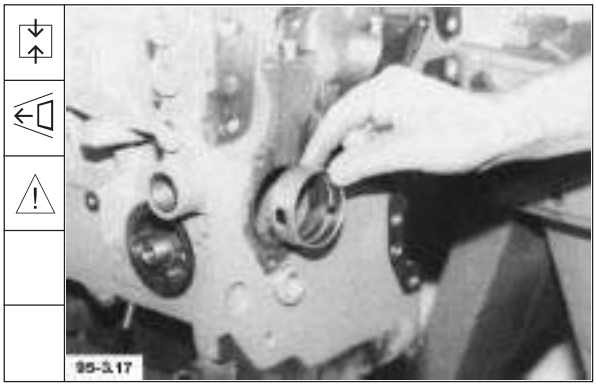


14. Schema: Einbaurichtung der Stoßfuge in der Lagerbuchse.

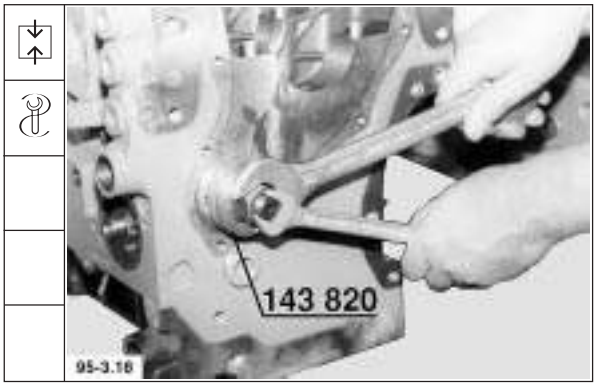


15. Neue Lagerbuchse ansetzen.

Hinweis: Auf Übereinstimmung der Schmieröl-bohrungen achten.



16. Lagerbuchse einziehen.



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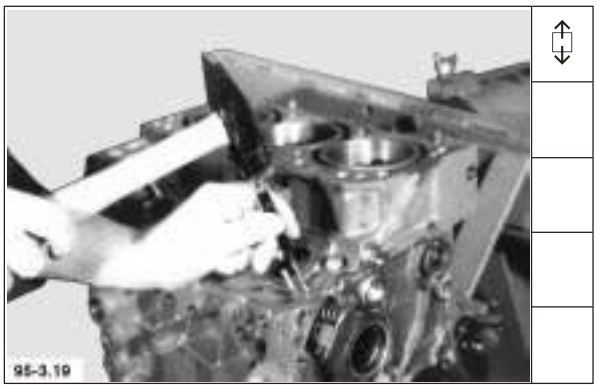
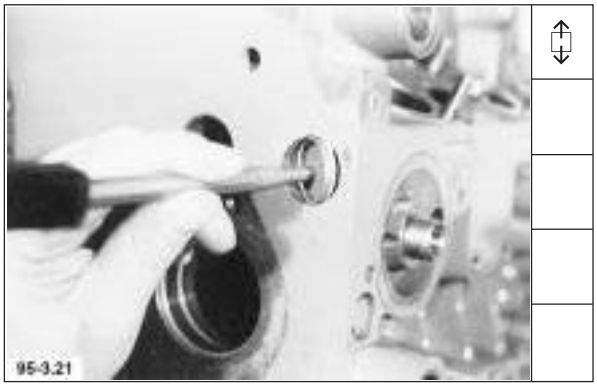
Deutsch



Regelstange und Führungsbuchsen

17. Zylinderstift austreiben.

18. Regelstange mit Feder herausnehmen.



19. Verschlußdeckel ausbauen.

20. Rohr mit einem Bohrer ø 5,5 mm einseitig durchbohren.

Hinweis: Nach dem Bohren ist das Kurbelgehäuse gründlich zu reinigen.

English

Control rod and guide bushes

17. Drive out parallel pin.

18. Remove control rod together with spring.

19. Remove cover.

20. Pierce pipe on one side with a drill of 5.5 mm dia.

Note: Carefully clean crankcase after drilling.

Français

Crémaillère et douille de guidage

17. Chasser la goupille cylindrique.

18. Retirer la crémaillère et le ressort.

19. Déposer le couvercle.

20. Percer d'un côté tube à l'aide d'un foret Ø 5,5 mm.

Nota: après avoir percé nettoyer soigneusement le bloc moteur.

Español

Cremallera y manguitos de guía

17. Desmontar golpeando el pasador cilíndrico.

18. Retirar la cremallera con resorte.

19. Desmontar la tapa de cierre.

20. Abrir un taladro en un lado del tubo mediante un macho Ø 5,5 mm.

Nota: Terminado el taladrado, es indispensable limpiar a fondo el bloque motor.

English

21. Insert puller until pin engages in bore.

22. Position spacer bush in place. Pull out pipe from lower press fit.

Note: Do not pull out pipe completely.

23. Press pin in until it does no longer project beyond the pipe. Now pull out pipe completely.

24. Drive out guide bush at front end.

Français

21. Mettre en place l'outil de montage jusqu'à encrantement du boulon dans l'alésage.

22. Mettre en place douille d'écartement. Retirer le tube du logement inférieur.

Nota: ne pas retirer entièrement le tube.

23. Enfoncer le boulon de manière à ce que, après contrôle visuel, il ne dépasse plus au niveau du tube. Retirer entièrement le tube maintenant.

24. Extraire à la partie avant douille de guidage.

Español

21. Introducir el extractor hasta que el perno se enclave en el taladro.

22. Colocar el casquillo distanciador. Extraer el tubo del ajuste forzado inferior.

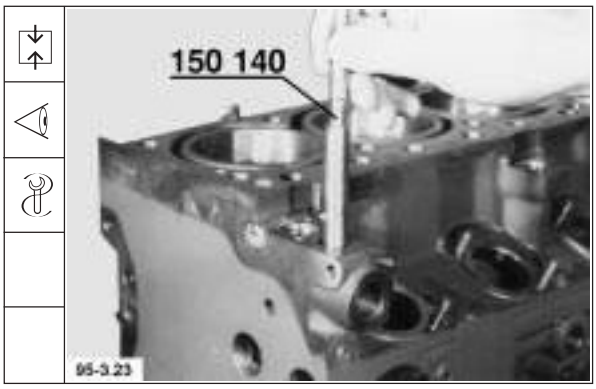
Nota: No extraer el tubo totalmente.

23. Introducir a presión el perno hasta que ya no se vea ningún resalto en el tubo. Hecho esto, extraer el tubo totalmente.

24. Desmontar golpeando el manguito de guía hacia adelante.

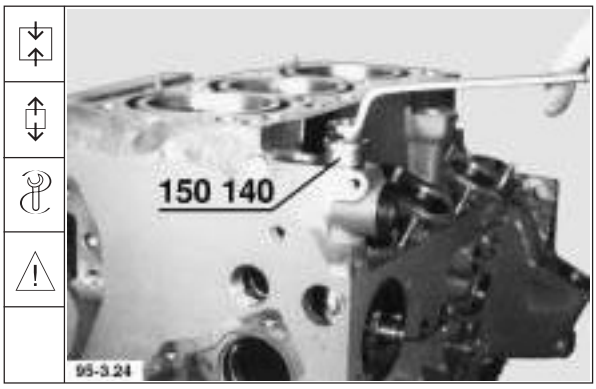
Deutsch

21. Ausziehwerkzeug einsetzen, bis der Bolzen in die Bohrung einrastet.

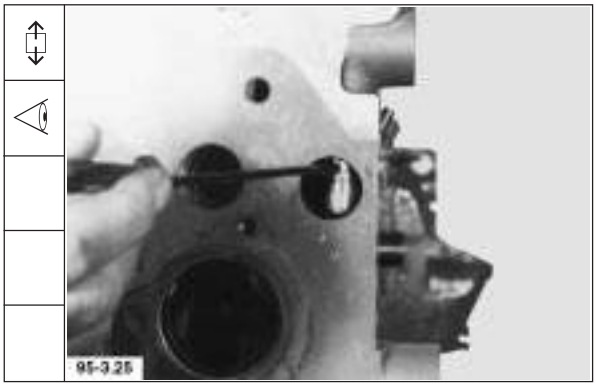


22. Abstandsbuchse aufsetzen. Rohr aus dem unteren Preßsitz herausziehen.

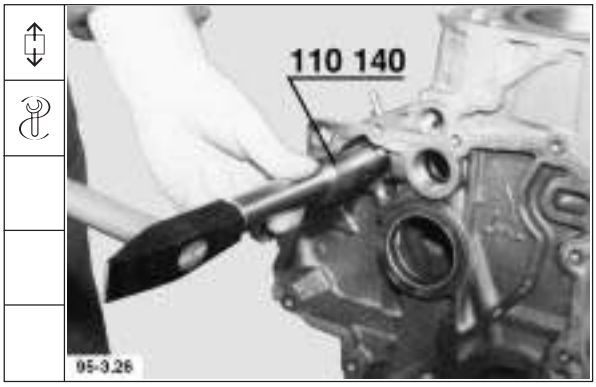
Hinweis: Rohr nicht ganz herausziehen.



23. Bolzen soweit eindrücken, bis kein Überstand am Rohr sichtbar ist. Jetzt Rohr ganz herausziehen.



24. Führungsbuchse vorn austreiben.



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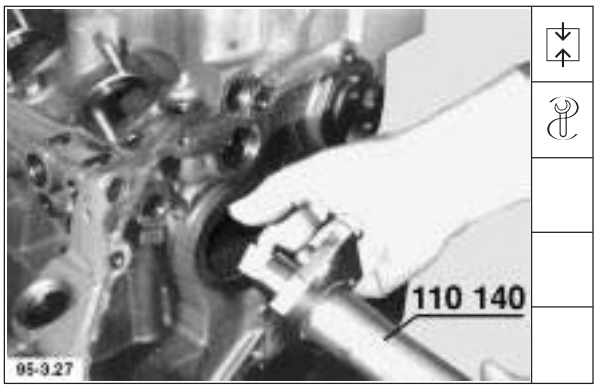
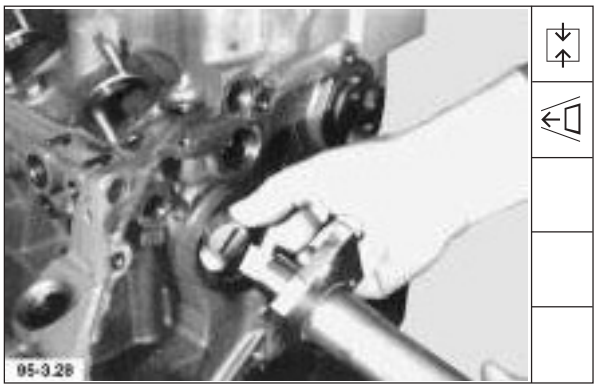
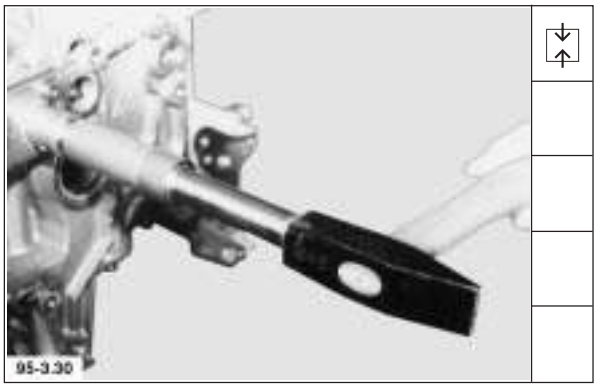


25. Montagedorn mit Abstandsbuchse in Zentrierung schieben.



26. Führungsbuchse auf den Montagedorn, mit der Anfasung zum Kurbelgehäuse weisend, aufsetzen.

27. Zentrierung mit Montagedorn und Führungsbuchse an Kurbelgehäuse festdrehen.



28. Führungsbuchse vorn bis Anlage eintreiben.

English

25. Introduce assembly arbor with spacer bush into centering.

26. Position guide bush on assembly arbor with chamfer pointing towards crankcase.

27. Secure centering with assembly arbor and guide bush on crankcase.

28. Drive in guide bush at front end as far as it will go.

Français

25. Insérer dans centrage mandrin de montage avec douille d'écartement.

26. Placer la douille de guidage sur le mandrin de montage en orientant le chanfrein vers le bloc moteur.

27. Au niveau du bloc moteur bloquer centrage avec mandrin de montage et douille de guidage.

28. Introduire douille de guidage AV jusqu'en position de butée.

Español

25. Introducir en el dispositivo de centraje el mandril de montaje con el casquillo distanciador puesto.

26. Colocar el manguito de guía sobre el mandril, con el bisel indicando hacia el bloque motor.

27. Fijar al bloque motor el dispositivo de centraje con el mandril de montaje y manguito de guía.

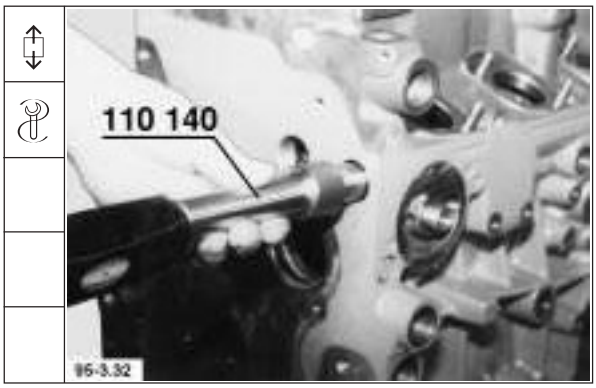
28. Introducir a golpes el manguito de guía hasta el tope.

English	Français	Español
29. Remove centering.	29. Déposer le centrage.	29. Desmontar el dispositivo de centraje.
30. Drive out guide bush at flywheel end.	30. Côté volant moteur extraire douille de guidage.	30. Desmontar golpeando el manguito de guía en el lado del volante.
31. Introduce assembly arbor without spacer bush into centering.	31. Introduire dans centrage mandrin de montage sans douille d'écartement.	31. Introducir en el dispositivo de centraje el mandril de montaje sin casquillo distanciador.
32. Position guide bush on assembly arbor with chamfer pointing towards crankcase.	32. Placer douille de guidage sur le mandrin de montage en orientant le chanfrein vers le bloc moteur.	32. Colocar el manguito de guía sobre el mandril, con el bisel indicando hacia el bloque motor.

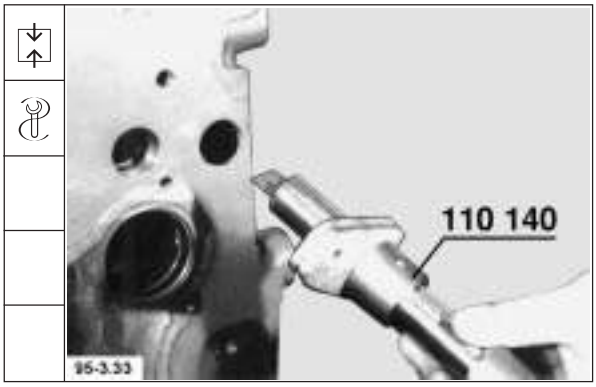
Deutsch

29. Zentrierung abbauen.

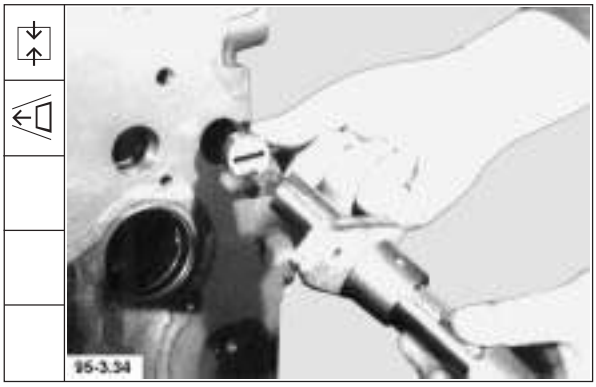
30. Führungsbuchse schwungradseitig austreiben.



31. Montagedorn ohne Abstandsbuchse in Zentrierung schieben.



32. Führungsbuchse auf den Montagedorn, mit der Anfasung zum Kurbelgehäuse weisend, aufsetzen.



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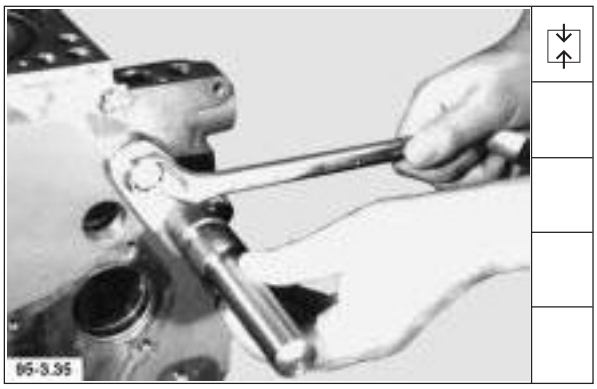
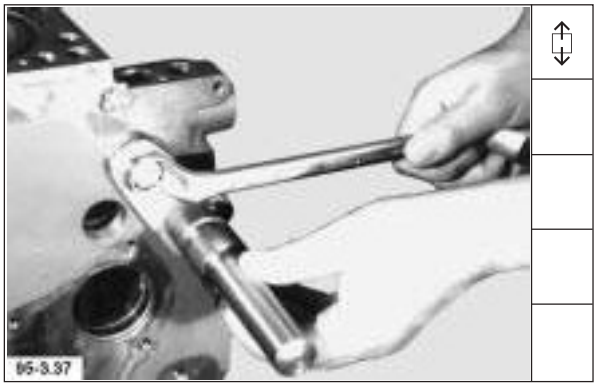
Deutsch

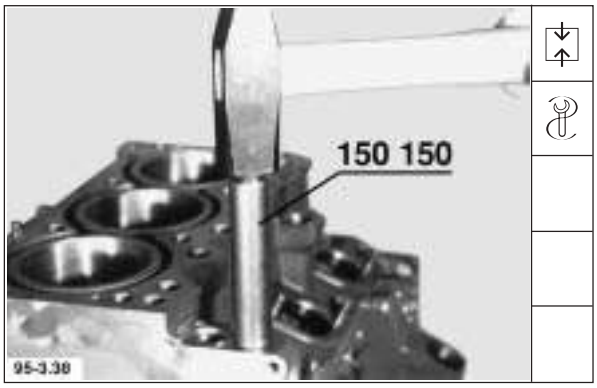


33. Zentrierung mit Montagedorn und Führungsbuchse an Kurbelgehäuse festdrehen.

34. Führungsbuchse schwungradseitig bis Anlage eintreiben.



35. Zentrierung abbauen.



36. Neues Rohr mit Montagedorn bis Anlage eindrücken.

English

33. Secure centering with assembly arbor and guide bush on crankcase.

34. Drive in guide bush at flywheel end as far as it will go.

35. Remove centering.

36. Press in new pipe with assembly arbor as far as it will go.

Français

33. Bloquer sur bloc moteur centrage avec mandrin de montage et douille de guidage.

34. Insérer côté volant moteur douille de guidage jusqu'en position de butée.

35. Déposer centrage.

36. A l'aide du mandrin de montage introduire tube neuf jusqu'en position de butée.

Español

33. Fijar al bloque motor el dispositivo con el mandril de montaje y manguito de guía.

34. Introducir a golpes, hasta el tope, el manguito de guía en el lado del volante.

35. Desmontar el dispositivo de centraje.

36. Introducir forzadamente, hasta el tope, el tubo nuevo utilizando el mandril de montaje.

English

37. Apply locking compound DEUTZ **DW 72** to new cover.

38. Drive in cover flush with crankcase.

39. Insert control rod with starter spring into guide bushes.

Note: Check for free movement.

40. Compress starter spring. Drive parallel pin into recess for control rod travel limitation. Check that it is flush with surface.

Français

37. Enduire de pâte de frein DEUTZ **DW 72** le couvercle neuf.

38. Insérer le couvercle jusqu'à affleurement dans bloc moteur.

39. Mettre en place dans les douilles de guidage crémaillère avec ressort du démarreur.

Nota: veiller à ce qu'il n'y ait aucun point dur.

40. Comprimer le ressort du démarreur puis insérer jusqu'à affleurement la goupille cylindrique dans l'évidement de la limite de déplacement du réglage.

Español

37. Aplicar pegamento de seguridad DEUTZ **DW 72** a la tapa de cierre nueva.

38. Colocar golpeando la tapa hasta que quede a ras en el bloque motor.

39. Introducir la cremallera con el resorte de arranque en los manguitos de guía.

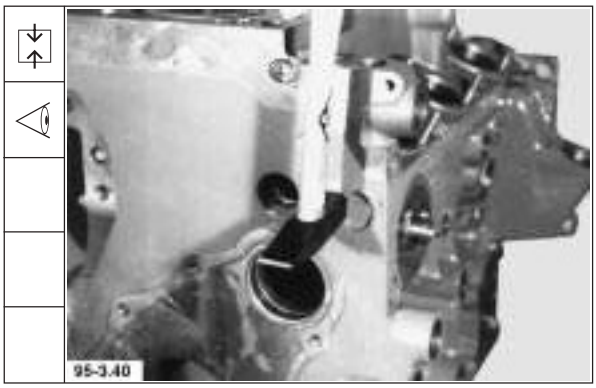
Nota: Prestar atención a su fácil movimiento.

40. Comprimir el resorte de arranque e introducir a presión en la escotadura para la limitación del recorrido de regulación el pasador cilíndrico hasta que quede a ras.

Deutsch

37. Neuen Verschlußdeckel mit Sicherungsmittel DEUTZ **DW 72** bestreichen.

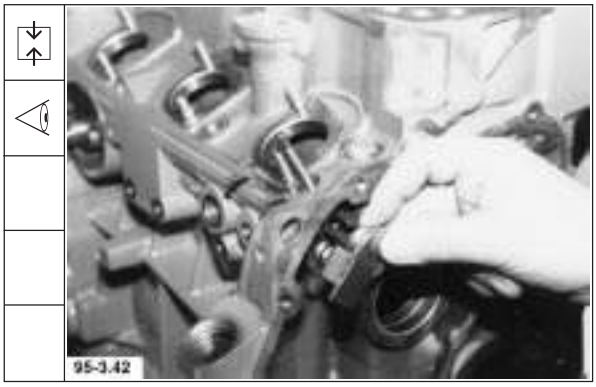
38. Verschlußdeckel bündig zum Kurbelgehäuse eintreiben.



39. Regelstange mit Starterfeder in die Führungsbuchsen einsetzen.

Hinweis: Auf Leichtgängigkeit achten.

40. Starterfeder zusammendrücken, Zylinderstift in die Aussparung für Regelwegbegrenzung bündig eintreiben.



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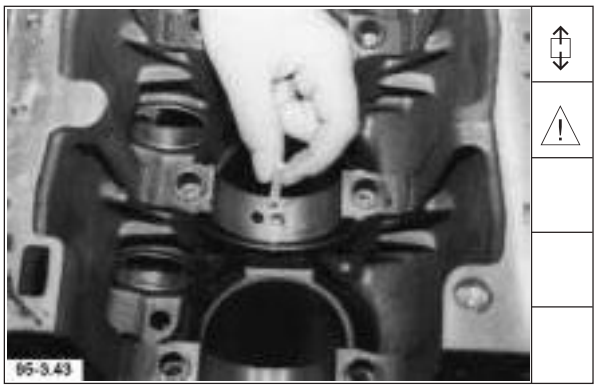
Deutsch

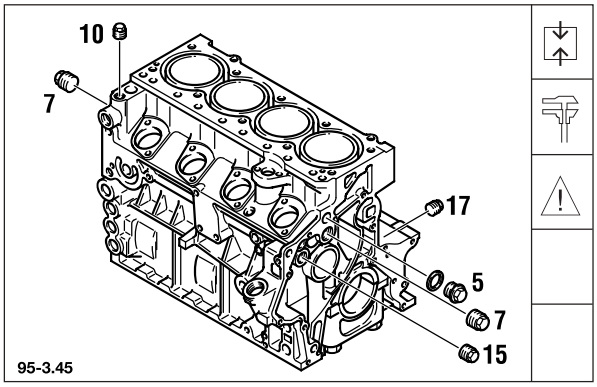


Kolbenkühlöldüsen

41. Kolbenkühlöldüsen herausdrücken.

Hinweis: Vor Einbau der neuen Kolbenkühlöldüsen müssen die Bohrungen im Zylinderkurbelgehäuse sauber sein.

42. Neue Kolbenkühlöldüsen bis Anlage eindrücken.



43. Verschlußschrauben festdrehen.

Anziehvorschrift:	Pos. 5 =	**50 Nm**
	Pos. 7 =	**95 Nm**
	Pos.10 =	**56 Nm**
	Pos.15 =	**50 Nm**
	Pos.17 =	**26 Nm**

Hinweis: Nach Demontage der Pos. 5 - 17 sind diese grundsächlich zu erneuern.

English

Piston cooling oil nozzles

41. Press out piston cooling oil nozzles.

Note: Before installing new piston cooling oil nozzles, check that the bores in the crankcase are clean and free of oil.

42. Press in new piston cooling oil nozzles as far as they will go.

43. Tighten screw plugs.

Tightening specification:

Item 5 =	**50 Nm**
Item 7 =	**95 Nm**
Item 10 =	**56 Nm**
Item 15 =	**50 Nm**
Item 17 =	**26 Nm**

Note: Always renew items 5 - 17 after removal.

Français

Gicleurs d'huile de refroidissement des têtes de pistons

41. Extraire les gicleurs d'huile.

Nota: avant de monter les nouveaux gicleurs d'huile veiller à ce que l'alésage se trouvant dans le bloc moteur soit parfaitement propre.

42. Visser les nouveaux gicleurs d'huile jusqu'en position de butée.

43. Bloquer les vis filetées.

Consigne de serage:

rep. 5 =	**50 Nm.**
rep. 7 =	**95 Nm.**
rep. 10 =	**56 Nm.**
rep. 15 =	**50 Nm.**
rep. 17 =	**26 Nm.**

Nota: après leur démontage toujours renouveller les vis des rep. 5 à 17.

Español

Toberas de refrigeración de pistones

41. Desmontar a presión las toberas de refrigeración de pistón.

Nota: Los orificios existentes en el bloque motor deben estar limpios antes de montar las toberas nuevas.

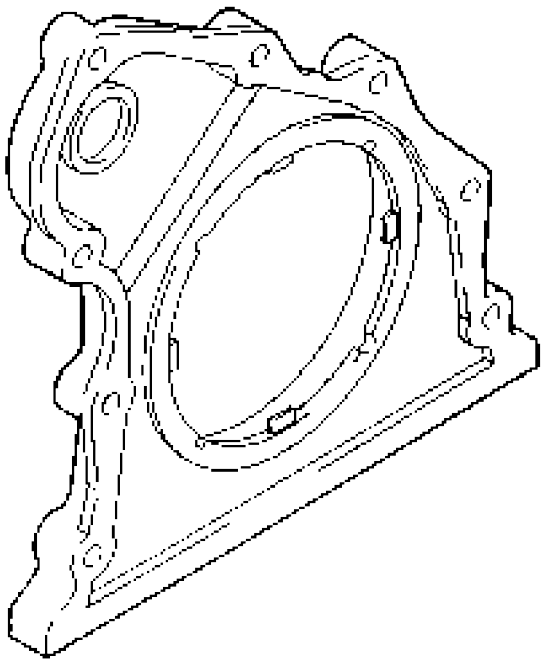
42. Introducir a presión, hasta el tope, las toberas nuevas.

43. Apretar los tapones de cierre.

Prescripción de apriete:

No. 5 =	**50 Nm**
No. 7 =	**95 Nm**
No. 10 =	**56 Nm**
No. 15 =	**50 Nm**
No. 17 =	**26 Nm**

Nota: Tras cada desmontaje de los tapones Nos. 5 - 17, es necesario reemplazarlos por otros nuevos.



English

Special tool required:

Assembly tool _____ 142 860

1. Drive out shaft seal.

2. Inspect cover, replace if necessary.

3. Installation depth of shaft seal.

Français

Outil spécial

Outil de montage _____ 142 860

1. Chasser le joint d'arbre.

2. Effectuer un contrôle visuel du couvercle, au besoin le changer.

3. Profondeur de montage du joint d'arbre.

Español

Herramienta especial:

Herramienta de montaje ___ 142 860

1. Sacar el retén.

2. Examinar visualmente la tapa, sustituyéndola en caso necesario.

3. Profundidad de montaje del retén.

Deutsch

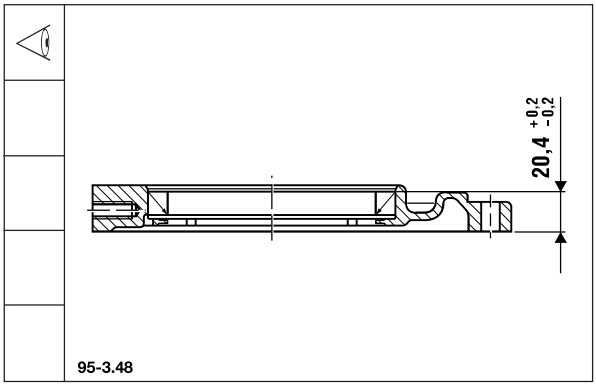
Spezialwerkzeug

Montagewerkzeug _____ 142 860

1. Wellendichtring austreiben.

2. Deckel sichtprüfen, ggf. austauschen.

3. Einbautiefe des Wellendichtringes.



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Deutsch

4. Wellendichtring ungeölt mit Montagevorrichtung montieren.

English

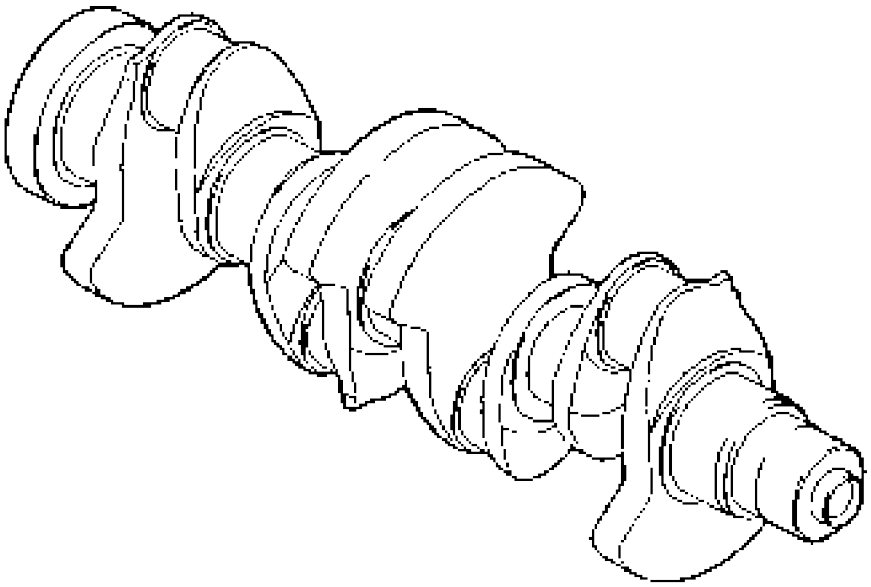
4. Fit shaft seal with assembly tool without using oil.

Français

4. Monter le joint d'arbre sans huile avec le dispositif de montage.

Español

4. Montar el retén sin aceitar utilizando el dispositivo de montaje.



English

1. Chuck crankshaft up on prism stand.

   Reworking sizes are marked on the outer contour of the cast-on counter-weight at flywheel end.

   H = ground main bearing journals
   P = ground crankpins

2. Schematic for gauging journals at points „1“ and „2“ in planes „a“ and „b“.

Journal diameter	**70** $^{-0.01}_{-0.03}$	**mm**
Each undersize	**0.25**	**mm**
Limit for undersize	**69.5** $^{-0.01}_{-0.03}$	**mm**
Wear limit:		
Journal ovality	**0.008**	**mm**

3. Gauge thrust bearing journal width.

Journal width	**35** $^{+0.04}$	**mm**
Each oversize	**0.4**	**mm**
Limit for oversize	**35.44**	**mm**

4. Gauge crankpins.

Pin diameter	**55** $^{-0.01}_{-0.03}$	**mm**
Each undersize	**0.25**	**mm**
Limit for undersize	**54.5** $^{-0.01}_{-0.03}$	**mm**
Wear limit:		
Pin ovality	**0.01**	**mm**

Français

1. Serrer le vilebrequin sur un support prismatique.

   Le repère des phases de retouche se fait sur les contours extérieurs du contre-poids rapporté côté volant moteur.

   H = tourillon rectifié
   P = maneton rectifié

2. Schéma de relevé des cotes des tourillons aux points „1“ et „2“ dans l’axe „a“ et „b“.

Diamètre des soies	**70** $^{-0,01}_{-0,03}$	**mm**
Cote de rectification	**0,25**	**mm**
Cote limite de rectification:	**69,5** $^{-0,01}_{-0,03}$	**mm**
Limite d’usure ovalisation des soies	**0,008**	**mm**

3. Relever la largeur du tourillon du palier d’ajustage.

Largeur maneton	**35** $^{+0,04}$	**mm**
Cote de rectification respective	**0,4**	**mm**
Cote limite de rectification	**35,44**	**mm**

4. Effectuer un relevé des cotes des manetons.

Diamètre des soies	**55** $^{-0,01}_{-0,03}$	**mm**
Cote de rectification	**0,25**	**mm**
Cote limite de rectification	**54,5** $^{-0,01}_{-0,03}$	**mm**
Limite d’usure ovalisation des soies	**0,01**	**mm**

Español

1. Colocar el cigüeñal sobre soportes prismáticos.

   La marcación de las medidas de rectificado se efectúa en el contorno exterior del contrapeso colocado en fundición, en el lado del volante.

   H = muñones de apoyo rectificados
   P = muñequillas rectificadas

2. Esquema para la verificación de las medidas de los muñones de apoyo en los puntos „1“ y „2“ de los planos „a“ y „b„.

Diámetro de muñón	**70** $^{-0,01}_{-0,03}$	**mm**
Cada inframedida	**0,25**	**mm**
Límite de inframedida	**69,5** $^{-0,01}_{-0,03}$	**mm**
Límite de desgaste: ovalización del muñón	**0,008**	**mm**

3. Medir el ancho del muñón del cojinete de empuje

Diámetro de muñón	**35** $^{+0,04}$	**mm**
Cada sobremedida	**0,4**	**mm**
Límite de sobremedida	**35,44**	**mm**

4. Medir la muñequilla.

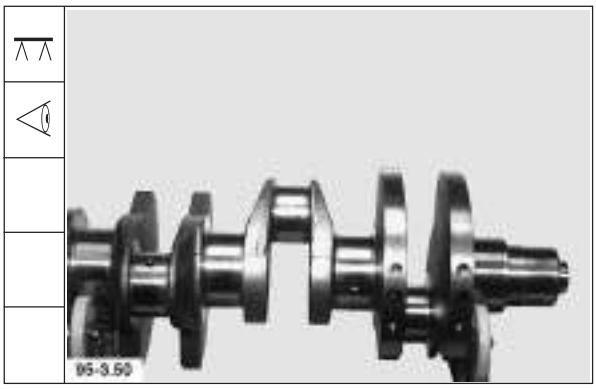
Diámetro de muñequilla	**55** $^{-0,01}_{-0,03}$	**mm**
Cada inframedida	**0,25**	**mm**
Límite de inframedida	**54,5** $^{-0,01}_{-0,03}$	**mm**
Límite de desgaste: ovalización del muñón	**0,01**	**mm**

Deutsch

1. Kurbelwelle in Prismen aufnehmen.

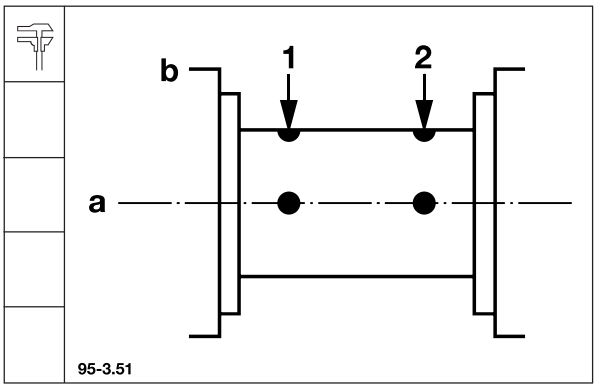
   Die Kennzeichnung der Nacharbeitsstufen er-folgt auf der Außenkontur des angegossenen, schwungradseitigen Gegengewichtes.

   H = geschliffene Hauptlagerzapfen
   P = geschliffene Pleuellagerzapfen



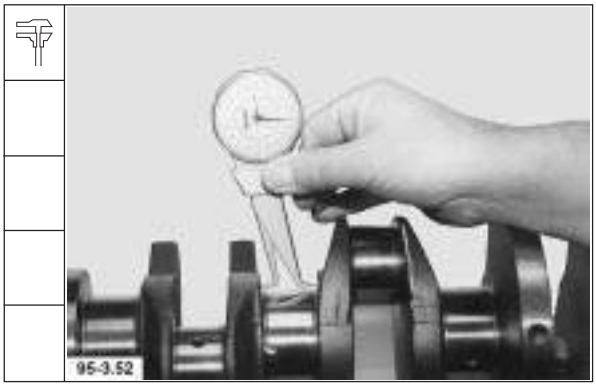
2. Schema zum Vermessen der Hauptlagerzapfen an den Stellen „1“ und „2” in der Ebene „a“ und „b“.

Zapfendurchmesser	**70** $^{-0,01}_{-0,03}$	**mm**
Untermaß je Stufe	**0,25**	**mm**
Grenzmaß für Untermaßstufe	**69,5** $^{-0,01}_{-0,03}$	**mm**
Verschleißgrenze: Zapfenunrundheit	**0,008**	**mm**



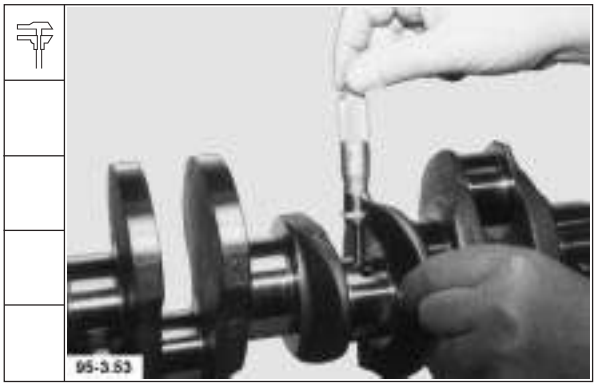
3. Breite des Paßlagerzapfens messen

Zapfenbreite	**35** $^{+0,04}$	**mm**
Übermaß je Stufe	**0,4**	**mm**
Grenzmaß für Übermaßstufe	**35,44**	**mm**



4. Hubzapfen messen

Zapfendurchmesser	**55** $^{-0,01}_{-0,03}$	**mm**
Untermaß je Stufe	**0,25**	**mm**
Grenzmaß für Untermaßstufe	**54,5** $^{-0,01}_{-0,03}$	**mm**
Verschleißgrenze: Zapfenunrundheit	**0,01**	**mm**



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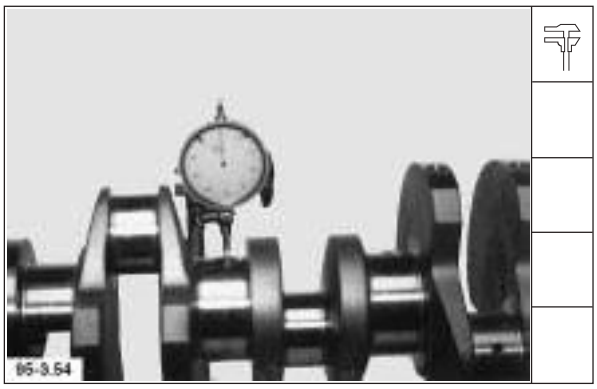
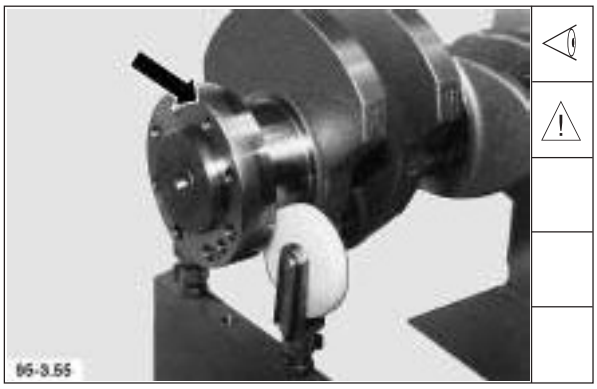
Deutsch



5. Kurbelwelle auf Rundlauf prüfen

   Abweichung max. **0,05 mm**



6. Laufflächen der Wellendichtringe sichtprüfen.

Hinweis: Bei verschlissener Kurbelwelle besteht die Möglichkeit die Kurbelwelle in unseren Service - Centern instand setzen zu lassen.

English

5. Check crankshaft for true running.

   Out of roundness max. **0.05 mm**

6. Inspect running surfaces of shaft seals.

Note: If crankshaft is worn, it is possible to have it reconditioned at our Service Centers.

Français

5. Vérifier la concentricité du vilebrequin.

   Ecart maxi **0,05 mm**

6. Contrôle visuel des surfaces de frottement des joints d'arbre.

Nota: en cas d'usure du vilebrequin vous pouvez le faire remettre en état dans un de nos Service Centers.

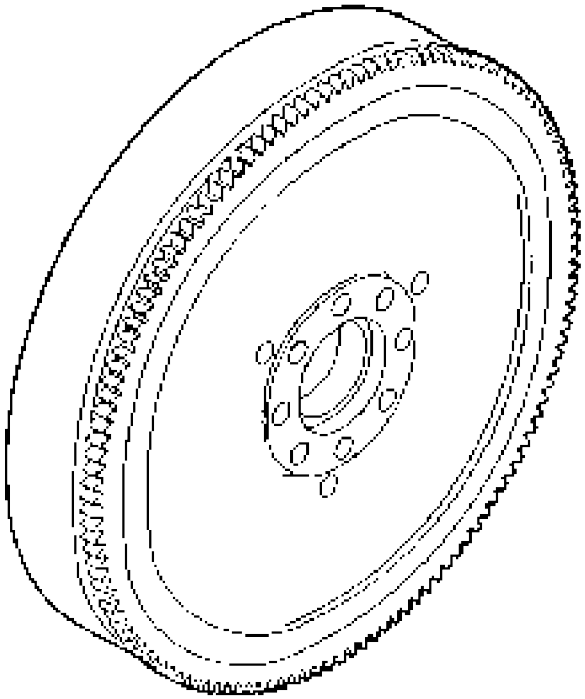
Español

5. Verificar el giro en redondo del cigüeñal.

   Desviación máx. **0,05 mm**

6. Examinar visualmente las superficies de roce de los retenes.

Nota: Si el cigüeñal está desgastado, existe la posibilidad de hacerlo reparar en uno de nuestros Centros de Servicio.



English

1. Drill ring gear apart.

Note: Make sure not to damage flywheel.

2. Remove ring gear.

3. Clean flywheel and inspect at supporting flange.

4. Heat ring gear to max. 220°C. Place ring gear in position and bring to stop at flange.

Français

1. Percer la couronne dentée.

Nota: ne pas endommager le volant moteur.

2. Oter la couronne.

3. Nettoyer le volant moteur et contrôler visuellement la collerette d'appui.

4. Réchauffer la couronne dentée à 220°C maximum.
La mettre en place de manière à ce qu'elle soit en position d'appui sur la collerette.

Español

1. Abrir taladrando la corona dentada.

Nota: Cuidar de no dañar el volante.

2. Quitar la corona dentada.

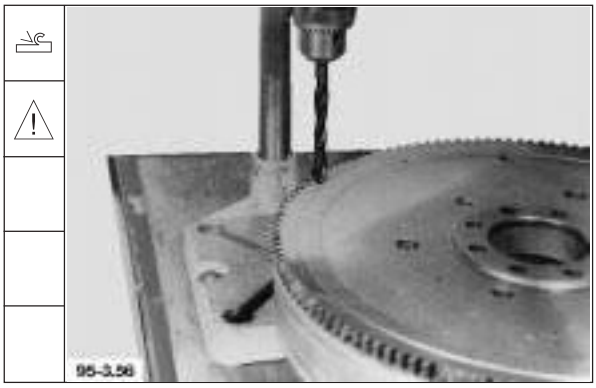
3. Limpiar el volante y examinar visualmente el collar de asiento.

4. Calentar la corona a 220°C como máximo. Colocarla en el volante y dejarla asentada en el collar.

Deutsch

1. Zahnkranz aufbohren

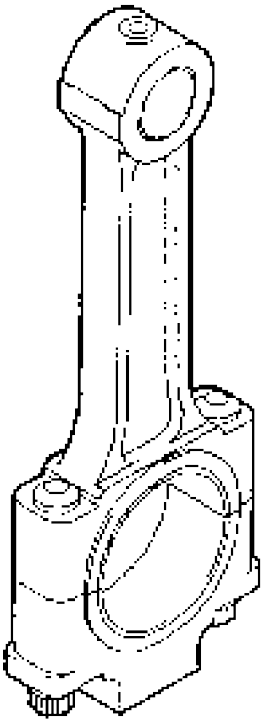
Hinweis: Schwungrad nicht beschädigen.



2. Zahnkranz entfernen.

3. Schwungrad reinigen und am Auflagebund sichtprüfen.

4. Zahnkranz auf max. 220° C erwärmen. Zahnkranz auflegen und am Bund zur Anlage bringen.



English

Special tools required:

Assembly tool for
small end bush 26 mm dia. __ 131 340
Assembly tool for small end
bush 30 mm dia. _____ 131 350

1. Set internal dial gauge.

   F 1011 F **26 mm dia.**
   BF 1011 F **30 mm dia.**

2. Gauge small end bush at points „1“ and „2“ in planes „a“ and „b“ -

3. - Gauge

   Specified value, small end bush pressed in:
   F 1011 F **26** $^{+0.035}_{+0.025}$ **mm**
   BF 1011 F **30** $^{+0.035}_{+0.025}$ **mm**
   Wear limit:
   Small end
   bush clearance **0.08 mm**

4. Replace small end bush if necessaray.

   Bore for small end bush:
   F 1011 F **29** $^{+0.02}$ **mm**
   BF 1011 F **33** $^{+0.02}$ **mm**

   Outer diameter
   of small end bush:
   F 1011 F **29** $^{+0.10}_{+0.06}$ **mm**
   BF 1011 F **33** $^{+0.110}_{+0.070}$ **mm**

Français

Bielle Mise en état des éléments

Outillage spécial:
Dispositif de montage de bague
de pied de bielle Ø 26 mm __ 131 340
Dispositif de montage de bague
de pied de bielle Ø 30 mm __ 131 350

1. Régler l’appareil de contrôle.

   F 1011F **Ø 26 mm**
   BF 1011 F **Ø 30 mm**

2. Procéder à un relevé des cotes de la bague de pied de bielle aux points „1“ et „2“ sur les axes „a“ et „b“.

3.

   Valeur de consigne de la bague
   de pied de bielle serrée
   F 1011 F **26** $^{+0,035}_{+0,025}$ **mm**
   BF 1011 F **30** $^{+0,035}_{+0,025}$ **mm**

   Limite d’usure jeu
   dans la bague **0,08 mm**

4. Au besoin remplacer la bague de pied de bielle.

   Alésage de bague de pied de bielle:
   F 1011 F **29** $^{+0.02}$ **mm**
   BF 1011 F **33** $^{+0.02}$ **mm**

   Bague de pied de bielle diamètre
   extérieur:
   F 1011 F **29** $^{+0,10}_{+0,06}$ **mm**
   BF 1011 F **33** $^{+0,110}_{+0,070}$ **mm**

Español

Herramientas especiales:

Herramienta de montaje para
casquillos de pie
de biela Ø 26 mm _____ 131 340
Herramienta de montaje para
casquillos de pie
de biela Ø 30 mm _____ 131 350

1. Ajustar el micrómetro de interiores.

   F 1011 F **Ø 26 mm**
   BF 1011 F **Ø 30 mm**

2. Verificar las medidas del casquillo de pie de biela en los puntos „1“ y „2“ de los planos „a“ y „b„.

3. Verificación.

   Valor prescrito casquillo
   introducido a presión:
   F 1011 F **26** $^{+0,035}_{+0,025}$ **mm**
   BF 1011 F **30** $^{+0,035}_{+0,025}$ **mm**

   Límite de desgaste:
   juego del bulón **0,08 mm**

4. Reemplazar el casquillo de pie de biela, si es necesario.

   Alojamiento del casquillo:
   F 1011 F **29** $^{+0.02}$ **mm**
   BF 1011 F **33** $^{+0.02}$ **mm**

   Diámetro exterior del casquillo de
   pie de biela:
   F 1011 F **29** $^{+0,10}_{+0,06}$ **mm**
   BF 1011 F **33** $^{+0,110}_{+0,070}$ **mm**

Deutsch

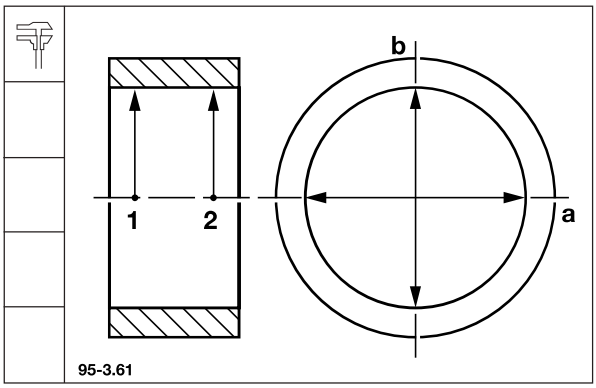
Spezialwerkzeug:

Montagevorrichtung für Kolbenbolzenbuchse ø 26 mm _____ 131 340
Montagevorrichtung für Kolbenbolzenbuchse ø 30 mm _____ 131 350

1. Innenmeßgerät einstellen.

   F 1011 F **ø 26 mm**
   BF 1011 F **ø 30 mm**

2. Kolbenbolzenbuchse an den Punkten „1“ und „2“ in der Ebene „a“ und „b“ -



3. - messen.

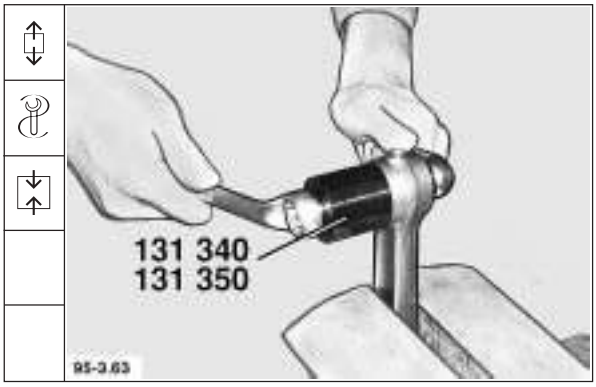
   Sollwert Kolbenbolzenbuchse eingepreßt:
   F 1011 F **26** $^{+0,035}_{+0,025}$ **mm**
   BF 1011 F **30** $^{+0,035}_{+0,025}$ **mm**

   Verschleißgrenze:
   Kolbenbolzenspiel **0,08** **mm**

4. Bei Bedarf Kolbenbolzenbuchse auswechseln.

   Bohrung für Kolbenbolzenbuchse:
   F 1011 F **29** $^{+0,02}$ **mm**
   BF 1011 F **33** $^{+0,02}$ **mm**

   Kolbenbolzenbuchse Außendurchmesser:
   F 1011 F **29** $^{+0,10}_{+0,06}$ **mm**
   BF 1011 F **33** $^{+0,110}_{+0,070}$ **mm**



Werkstatthandbuch 1011 F

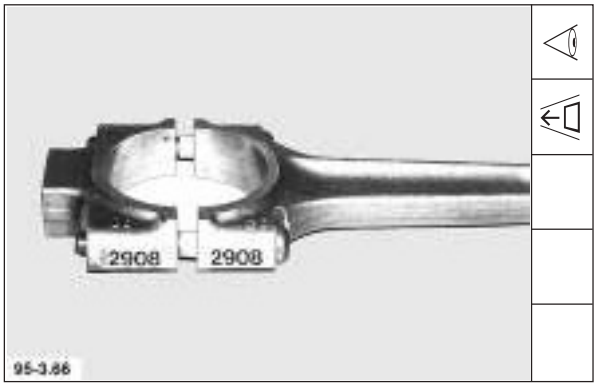
Deutsch

5. Kolbenbolzenbuchse bündig einpressen.

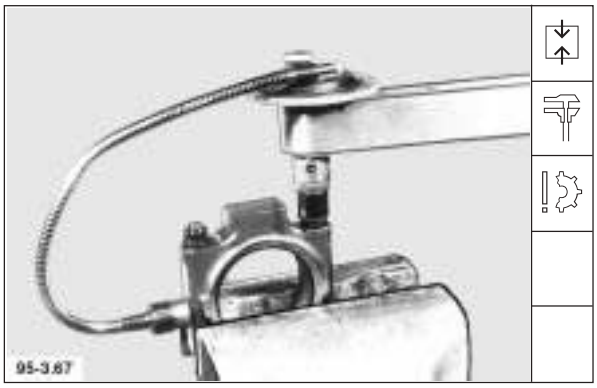
Hinweis: Schmierölbohrung der Kolbenbolzenbuchse und der Pleuelstange müssen übereinstimmen.

6. Kolbenbolzenbuchse nach dem Einpressen ausspindeln.

F 1011 F	**26** $^{+0,035}_{+0,025}$ **mm**
BF 1011 F	**30** $^{+0,035}_{+0,025}$ **mm**



7. Pleuellagerdeckel zuordnen.



8. Pleuellagerdeckel montieren. Muttern mit **12 kant-Steckschlüssel** festdrehen.

Anziehvorschrift:

Vorspannwert	**30 Nm**
1. Nachspannwinkel	**60°**
2. Nachspannwinkel	**60°**

English

5. Press in small end bush flush.

Note: Lube oil bores of small end bush and connecting rod must be in line.

6. After pressing in, precision-bore small end bush on a fine boring mill.

F 1011 F	**26** $^{+0,035}_{+0,025}$ **mm**
BF 1011 F	**30** $^{+0,035}_{+0,025}$ **mm**

7. Make sure that cap mates with connecting rod.

8. Fit bearing cap. Tighten nuts with **dodecagonal socket wrench**.

Tightening specification:	
Initial tightening torque	**30 Nm**
1st tightening angle	**60°**
2nd tightening angle	**60°**

Français

5. Insérer jusqu'à affleurement bague de pied de bielle.

Nota: les trous de passage d'huile de la bague de pied de bielle et de la bielle doivent correspondre.

6. Après l'avoir insérée usiner à la broche la bague du pied de bielle.

F 1011 F	**26** $^{+0.035}_{+0.025}$ **mm**
BF 1011 F	**30** $^{+0.035}_{+0.025}$ **mm**

7. Bien positionner selon le numéro repère le chapeau de bielle.

8. Monter le chapeau de bielle. Serrer les écrous avec la **clé à douille 12 pans** selon les préconisations de **serrage.**

Consigne de serrage:	
Valeur de préserrage:	**30 Nm**
1er serrage à l'angle	**60°**
2e serrage à l'angle	**60°**

Español

5. Insertar a ras el casquillo de pie de biela.

Nota: Los orificios de lubricación existentes en el casquillo de pie de biela y en la biela deben coincidir.

6. Una vez insertado, mecanizar el casquillo de pie de biela en mandrinadora de precisión.

F 1011 F	**26** $^{+0,035}_{+0,025}$ **mm**
BF 1011 F	**30** $^{+0,035}_{+0,025}$ **mm**

7. Elegir la tapa de biela que corresponda.

8. Montar la tapa de biela. Apretar las tuercas utilizando la **llave de vaso de doce cantos.**

Prescripción de apriete:	
Apriete inicial	**30 Nm**
1er ángulo de reapriete	**60°**
2o ángulo de reapriete	**60°**

English

9. Set internal dial gauge.

   Dia. 58.5 mm

10. Schematic for gauging big end bearing bore at points „1“ and „2“ in planes „a“ and „b“.

    Bore for big end bearing **58.5** $^{+0.02}$ **mm**

11. If the gauge readings conform to the specified values, the necessary preload will be obtained after fitting the bearing shells.

Note: If the measured values deviate only slightly, additional measurements are to be carried out with new bearing shells fitted.

12. Remove bearing cap and fit new bearing shells. Refit bearing cap. Tighten nuts.

    Tightening specification:
    Initial tightening torque **30 Nm**
    1st tightening angle **60°**
    2nd tightening angle **60°**

Français

9. Mettre en place l’appareil de mesure.
   Ø 58,5 mm

10. Schéma de mesurage de l’alésage de coussinet de bielle aux points „1“ et „2“ du plan „a“ et „b“

    Alésage des coussinets de bielle **58,5** $^{+0,02}$ **mm**

11. Si les mesures correspondent aux valeurs indiquées, c’est que après montage des coussinets la précontrainte est établie.

Nota: Si, en revanche, les valeurs enregistrées ne s’écartent que faiblement, procéder à de nouvelles mesures avec des coussinets neufs.

12. Déposer le chapeau de bielle et mettre en place des coussinets neufs. Monter le chapeau de bielle. Serrer les écrous selon les préconisations de serrage.

    Consigne de serrage:
    Valeur de préserrage: **30 Nm**
    1er serrage à l’angle **60°**
    2e serrage à l’angle **60°**

Español

9. Ajustar el micrómetro de interiores.
   Ø 58,5 mm

10. Esquema para la verificación de las medidas de alojamiento de los cojinetes de cabeza de biela, en los puntos „1“ y „2“ de los planos „a“ y „b„.

    Alojamiento para cojinetes de biela **58,5** $^{+0,02}$ **mm**

11. Si los valores medidos corresponden a los especificados, los semicojinetes recibirán la pretensión necesaria después de su montaje.

Nota: Si, en cambio, los valores medidos sólo difieren insignificantemente, es necesario realizar mediciones adicionales con semicojinetes nuevos.

12. Desmontar la tapa de biela e introducir los semicojinetes nuevos. Volver a montar la tapa y apretar las tuercas.

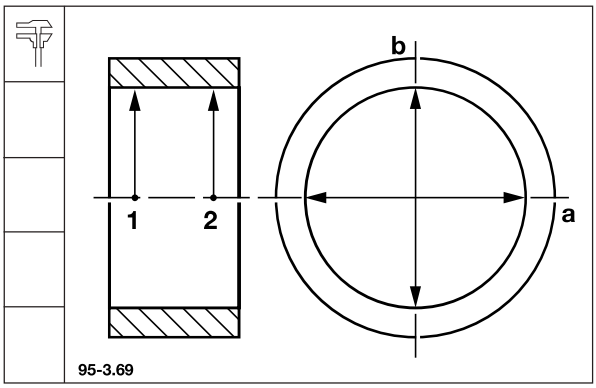
    Prescripción de apriete:
    Apriete inicial **30 Nm**
    1er ángulo de reapriete **60°**
    2o ángulo de reapriete **60°**

Deutsch

9. Innenmeßgerät einstellen.
   ø 58,5 mm

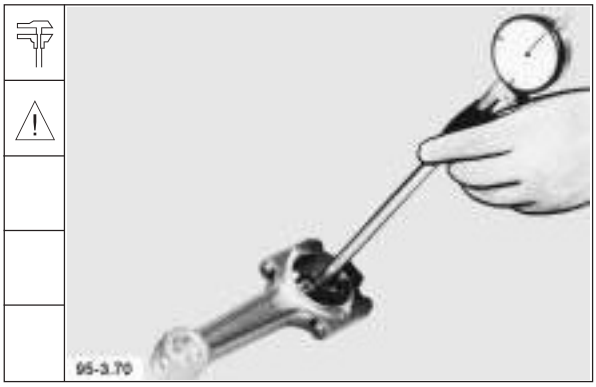
10. Schema zum Vermessen der Pleuellagerbohrung an den Punkten „1“ und „2“ der Ebene „a“ und „b“.

    Bohrung für Pleuellager **58,5** $^{+0,02}$ **mm**



11. Entsprechen die Messungen den angegebenen Werten, ist nach dem Einbau von Lagerschalen die Vorspannung vorhanden.

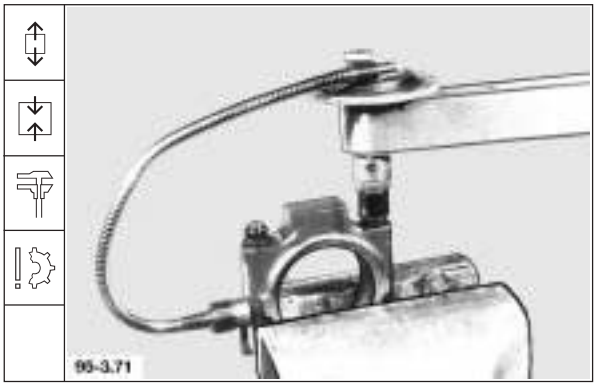
Hinweis: Weichen die Meßwerte nur geringfügig ab, sind zusätzliche Messungen mit neuen Lagerschalen durchzuführen.



12. Pleuellagerdeckel abbauen und neue Lagerschalen einsetzen. Pleuellagerdeckel montieren. Muttern festdrehen.

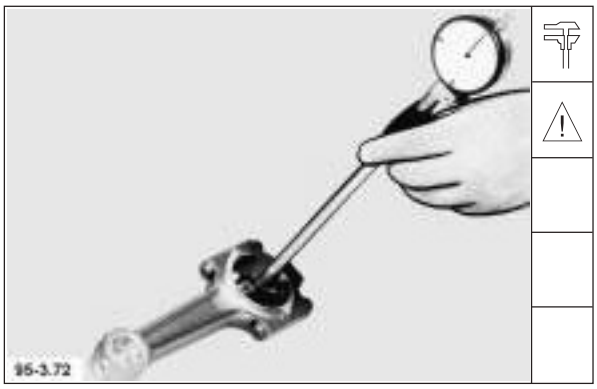
    Anziehvorschrift:

Vorspannwert	**30 Nm**
1. Nachspannwinkel	**60°**
2. Nachspannwinkel	**60°**



Werkstatthandbuch 1011 F

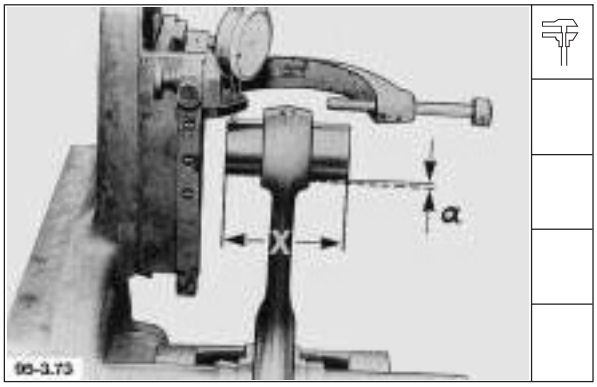
Deutsch



13. Innenmeßgerät einstellen. Lagerschalen an den Punkten „1“ und „2“ in den Ebenen „a“ und „b“ messen.

Pleuellagerschalen Innendurchmesser	**55,004 - 55,04 mm**
Untermaß je Stufe	**0,25 mm**
Grenzmaß für Untermaßstufe	**54,504 - 54,54 mm**
Verschleißgrenze: Pleuellager Radialspiel	**0,12 mm**

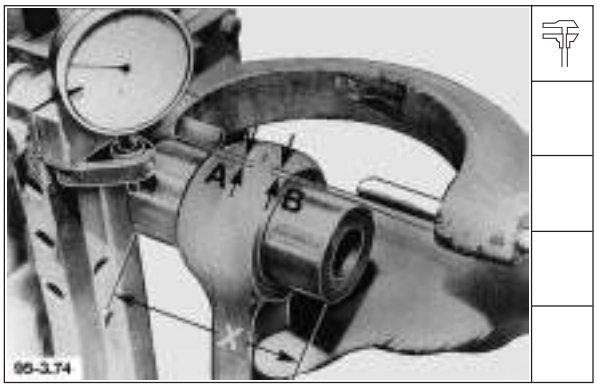
Hinweis: Liegen die Werte bis. max. **0,015 mm** über den Lagertoleranzen, kann die Pleuelstange weiter verwendet werden. Wird der Grenzwert überschritten, Pleuelstange austauschen.



14. Pleuelstange ohne Lagerschalen auf einem Pleuelprüfgerät prüfen.-

14.1 auf Parallelität:

Zulässige Abweichung a = **0,10 mm** bei einem Abstand von x = **100 mm**



14.2 auf Winkligkeit:

Zulässige Abweichung „A“ zu „B“= **0,05 mm**

English

13. Set internal dial gauge. Gauge bearing shells at points „1“ and „2“ in planes „a“ and „b“.

Inner diameter of big end bearing shells **55.004 - 55.04 mm**
Each undersize **0.25 mm**
Limit for undersize **54.504 - 54.54 mm**
Wear limit: Radial clearance of big end bearing **0.12 mm**

Note: If the readings do not exceed bearing tolerances by more than **0.015 mm** , the rod can be used further. If the limit value is exceeded, replace the connecting rod.

14. Check connecting rod without bearing shells on connecting rod tester. -

14.1 Parallelism check:

Permissible tolerance a = **0.10 mm**
over a distance of x = **100 mm**

14.2 Squareness check:

Permissible tolerance „A“ relative to „B“ = **0.05 mm**

Français

13. Régler l’appareil de contrôle. Effectuer le relevé des cotes des coussinets aux points „1“ et „2“ au niveau des plans „a“ et „b“.

Coussinets de bielle diamètre intérieur **55,004 - 55,04 mm**
Cote de rectification **0,25 mm**
Cote limite pour cote de rectification **54,504 - 55,54 mm**
Limite d’usure coussinets de bielle jeu radial **0,12 mm**

Nota : Si les valeurs dépassent au maximum de **0,015 mm** les tolérances du coussinet, la bielle peut rester en service. Dans le cas contraire, la remplacer.

14. Contrôler toute bielle sans coussinet sur un appareil de contrôle notamment

14.1 au niveau du parallélisme

Ecart admissible pour un écartement de a = **0,10 mm**
x = **100 mm**

14.2 et de l’équerrage

Ecart admissible „A“ par rapport „B“ = **0,05 mm**

Español

13. Ajustar el micrómetro de interiores. Verificar las medidas de los semicojinetes en los puntos „1“ y „2“ de los planos „a“ y „b„.

Diámetro interior cojinetes de biela **55,004 - 55,04 mm**
Cada inframedida **0,25 mm**
Límite de inframedida **54,504 - 54,54 mm**
Límite de desgaste: juego radial cojinete **0,12 mm**

Nota: Si los valores medidos no sobrepasan en más de **0,015 mm** las tolerancias del cojinete, la biela puede seguir utilizándose. En caso contrario, reemplazar la biela.

14. Comprobar la biela desprovista de los semicojinetes sobre un aparato para la comprobación de bielas:

14.1 Prueba de paralelismo:

Desviación admisible a la distancia de a = **0,10 mm**
x = **100 mm**

14.2 Prueba de la perpendicularidad:

Desviación admisible „A“ respecto a „B“ **= 0,05 mm**

English

Assembling connecting rod with piston

15. Fit circlip.

Note: Ring gaps of circlips must face piston crown.

16. Install piston together with connecting rod. Flywheel symbol on the piston must point to the left and identification number on connecting rod must be visible.

17. Fit second circlip and bring into correct position.

Français

Compléter l'ensemble bielle-piston

15. Mettre en place un premier circlip.

Nota: les coupes des circlips doivent être orientées dans le sens de la tête du piston.

16. Monter l'ensemble piston-bielle. Le symbole du volant moteur figurant sur le piston doit être orienté vers la gauche et le chiffre de la bielle doit être bien visible.

17. Placer et ajuster le deuxième circlip.

Español

Unión de la biela y pistón

15. Colocar uno de los anillos de retención.

Nota: Los cortes de los anillos de retención deben indicar hacia la cabeza del pistón.

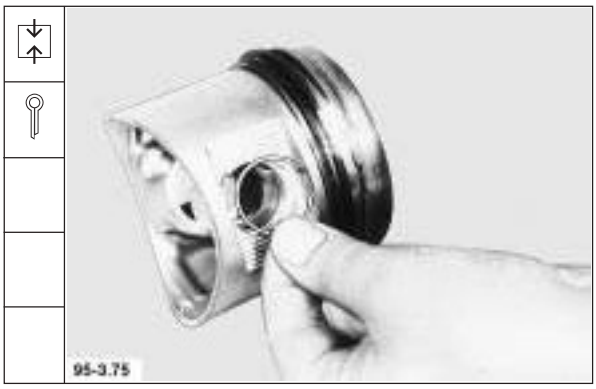
16. Unir el pistón con la biela. El símbolo del volante que figura en el pistón debe indicar hacia la izquierda y el número de identificación de la biela debe ser visible.

17. Introducir el segundo anillo de retención y alinearlo.

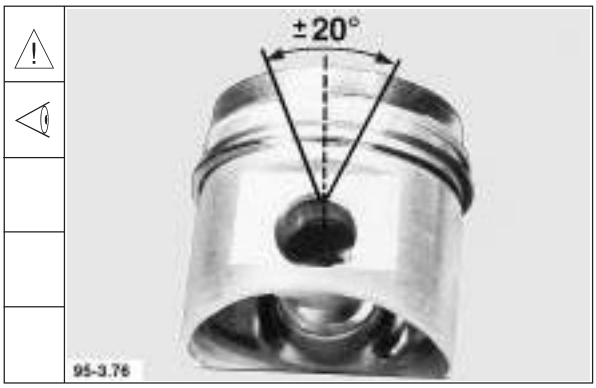
Deutsch

Pleuelstange mit Kolben komplettieren

15. Einen Sicherungsring einsetzen.

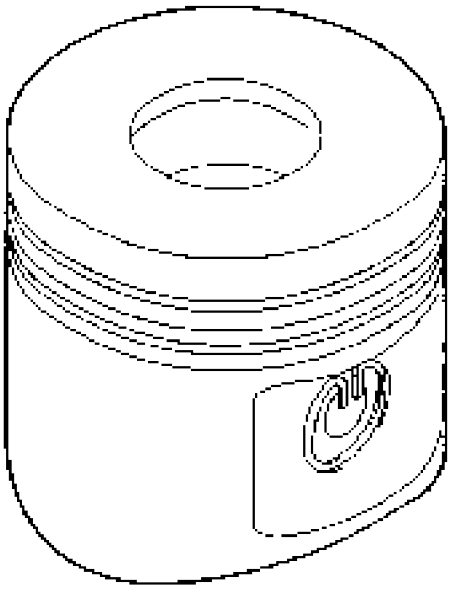


Hinweis: Ringstöße der Sicherungsringe müssen zum Kolbenboden zeigen.



16. Kolben mit der Pleuelstange montieren. Das Schwungradsymbol auf dem Kolben muß nach links zeigen und die Kennziffer der Pleuelstange muß sichtbar sein.

17. Zweiten Sicherungsring einsetzen und ausrichten.



English

Special tool required:

Piston ring pliers _____ 130 300

1. Remove circlip. Take out piston pin.

2. Adjust piston ring pliers to piston diameter. Remove piston rings.

3. Clean and inspect piston and ring grooves.

Français

Outillage spécial:

Pince à monter les segments de piston _____ 130 300

1. Enlever le circlip et retirer l'axe du piston.

2. Régler la pince à monter les segments sur le diamètre du piston. Déposer les segments.

3. Nettoyer le piston et les gorges annulaires puis faire un contrôle visuel.

Español

Herramienta especial:

Alicates para montar aros de pistón _____ 130 300

1. Quitar el anillo de retención. Sacar el bulón del pistón.

2. Ajustar los alicates para aros de pistón al diámetro del pistón y desmontar los aros.

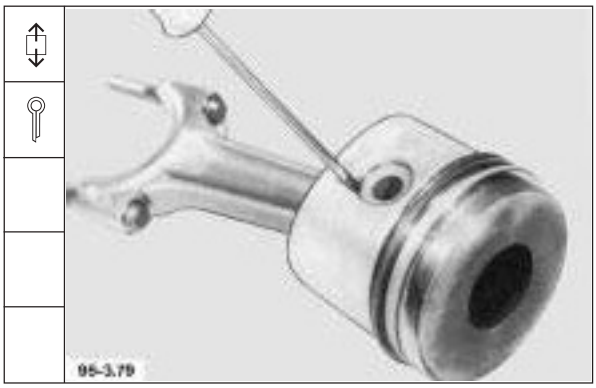
3. Limpiar y examinar visualmente el pistón y las ranuras para los aros.

Deutsch

Spezialwerkzeug:

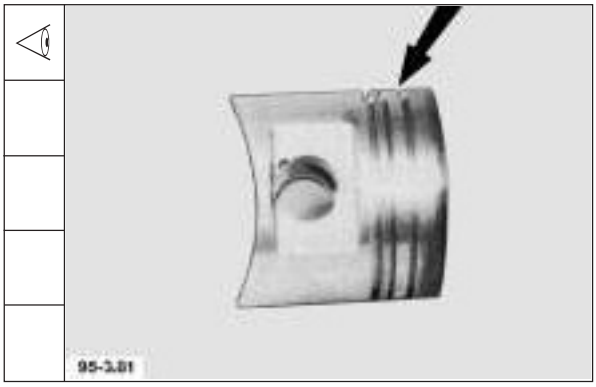
Kolbenring-Auflegezange: _____ 130 300

1. Sicherungsring entfernen. Kolbenbolzen herausnehmen.



2. Kolbenring-Auflegezange auf den Kolbendurchmesser einstellen. Kolbenringe abbauen.

3. Kolben und Ringnuten reinigen und sichtprüfen.



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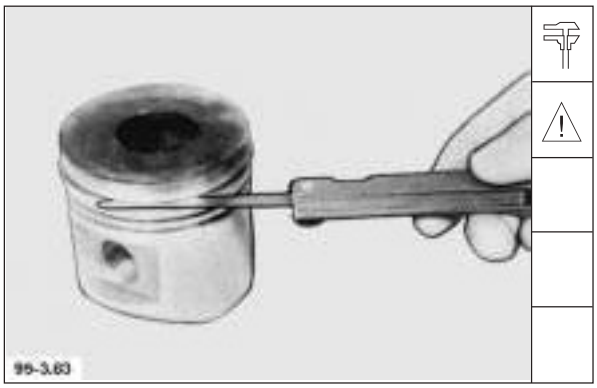
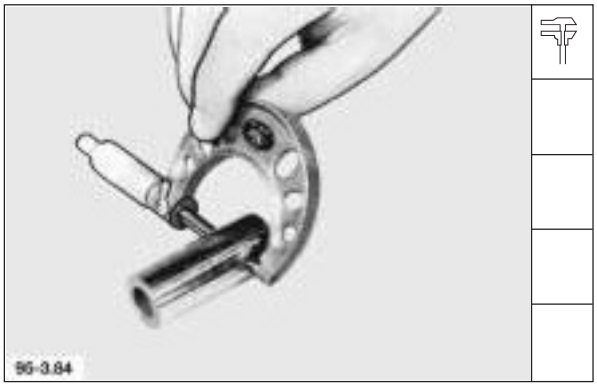
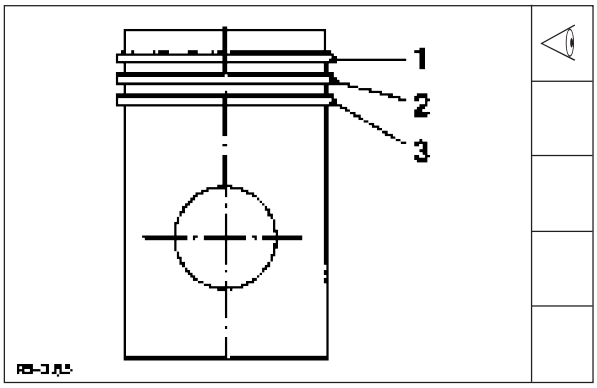






Deutsch

4. Kolbenringstoßspiel mit Fühlerlehre messen.

   Verschleißgrenzen:

Stoßspiel 1. Ring	**0,8 mm**
Stoßspiel 2. Ring	**1,8 mm**
Stoßspiel 3. Ring F 1011 F	**1,2 mm**
Stoßspiel 3. Ring BF 1011 F	**0,9 mm**

5. Kolbenringnuten mit Fühlerlehre messen.

Hinweis: Messung mit neuen Kolbenringen durchführen.

   Verschleißgrenzen:

Axialspiel 1. Ring F 1011 F	**0,2 mm**
Axialspiel 1. Ring BF 1011 F	--
Axialspiel 2. Ring	**0,16 mm**
Axialspiel 3. Ring	**0,12 mm**

6. Kolbenbolzen auf Verschleiß prüfen.

   Kolbenbolzendurchmesser:

F 1011 F	**$26_{-0,005}$ mm**
BF 1011 F	**$30_{-0,005}$ mm**

7. Reihenfolge und Lage der Kolbenringe:

   1. F 1011 F, Rechteckring, Top zum Brennraum weisend.
   1. BF 1011 F, Doppeltrapezring, Top zum Brennraum weisend.
   2. Minutenring, Top zum Brennraum weisend.
   3. Ölschlitz-Dachfasenring

English

4. Measure ring gap with feeler gauge.

Wear limits:

1st ring gap	**0.8 mm**
2nd ring gap	**1.8 mm**
3rd ring gap F 1011 F	**1.2 mm**
3rd ring gap BF 1011 F	**0.9 mm**

5. Measure ring grooves with feeler gauge.

Note: Measurement to be made with new piston rings.

Wear limits:

axial play 1st ring F 1011 F	**0.2 mm**
axial play 1st ring BF 1011 F	**- -**
axial play 2nd ring	**0.16 mm**
axial play 3rd ring	**0.12 mm**

6. Check piston pin for wear.

Piston pin diameter:

F 1011 F	**$26_{-0.005}$ mm**
BF 1011 F	**$30_{-0.005}$ mm**

7. Order and position of piston rings:

1. F 1011 F, rectangular ring, top facing combustion chamber
1. BF 1011 F, keystrone ring, top facing combustion chamber
2. tapered compression ring, top facing combustion chamber
3. bevelled-edge slotted oil control ring

Français

4. Mesurer le jeu à la coupe avec une jauge d'épaisseur.

Limites d'usure: Jeu à la coupe

1er segment	**0,8 mm**
2e segment	**1,8 mm**
3e segment F 1011 F	**1,2 mm**
3e segment BF 1011 F	**0,9 mm**

5. Relever les cotes des gorges de segments avec une jauge d'épaisseur.

Nota: Effectuer Les mesures avec des segments neufs.

Limites d'usure: jeu axial

1er segment F 1011 F	**0,2 mm**
1er segment BF 1011 F	**- -**
2e segment	**0,16 mm**
3e segment	**0,12 mm**

6. Contrôler l'usure de l'axe du piston.

Diamètre de l'axe du piston

F 1011 F	**$26_{-0,005}$ mm**
BF 1011 F	**$30_{-0,005}$ mm**

7. Ordre et position des segments:

1. F 1011 F, segment à section rectangulaire,top orienté vers la chambre de combustion
1. BF 1011 F segment trapézoïdal double, top orienté vers la chambre de combustion
2. segment biseauté, top orienté vers la chambre de combustion
3. segment racleur à double chanfrein

Español

4. Medir la distancia entre las puntas de los aros mediante una galga de espesores.

Límites de desgaste:

distancia 1er aro	**0,8 mm**
distancia 2o aro	**1,8 mm**
distancia 3er aro F 1011 F	**1,2 mm**
distancia 3er aro BF 1011 F	**0,9 mm**

5. Medir las ranuras para aros mediante una galga de espesores.

Nota: Realizar la medición con aros nuevos.

Límites de desgaste:

juego axial 1er aro F 1011 F	**0,2 mm**
juego axial 1er aro BF 1011 F	**- -**
juego axial 2o aro	**0,16 mm**
juego axial 3er aro	**0,12 mm**

6. Verificar el bulón en cuanto a desgaste.

Diámetro del bulón:

F 1011 F	**$26_{-0,005}$ mm**
BF 1011 F	**$30_{-0,005}$ mm**

7. Orden de sucesión y posición de los aros:

1. F 1011 F, aro de sección rectangular, con „Top" indicando hacia la cámara de combustión
1. BF 1011 F, aro de doble cuña, con „Top" indicando hacia la cámara de combustión
2. Aro con bisel de pequeño ángulo, con „Top" indicando hacia la cámara de combustión.
3. Aro ranurado de aceite con chaflán

English

8. Fit piston rings

Note: Spring gap of bevelled-edge ring to be offset by **180**° relative to ring gap.

Note: With **FL engines**, regular production pistons are installed with the following compression heights

hKH A = **55.17 mm**
hKH B = **55.27 mm**
hKH C = **55.37 mm**

and with **FM engines** with the compression heights

hKH A = **51.67 mm**
hKH B = **51.77 mm**
hKHC = **51.87 mm**

The identification numbers of the piston variants are stamped on the piston crown. When exchanging a piston, make sure that a piston with the same compression height is installed. When replacing the crankshaft or crankcase, the distance between „top edge of crankpin in TDC and cylinder head gasket seating surface“ has to be measured again to determine the piston compression height. See Chapter 4.

With **BF engines**, the measurement is not necessary for determining the piston compression height as only pistons with the compression height hKH A = **55.17 mm** are installed in BFL engines and hkH A = **51.67 mm** in BFM engines.

Français

8. Monter les segments de piston.

Nota: décaler la coupe du ressort du segment racleur de **180**° par rapport à la coupe de segment.

Nota: Les **moteurs FL** sont équipés de série de pistons présentant les taux de compression suivants:

hKH A = **55,17 mm**
hKH B = **55,27 mm**
hKH C = **55,37 mm**

quant aux **moteurs FM**, leurs taux de compression sont les suivants:

hKH A = **51,67 mm**
hKH B = **51,77 mm**
hKH C = **51,87 mm.**

Les différents modèles de piston sont marqués sur la tête du piston.
A chaque changement de piston veiller à toujours réutiliser la même catégorie de taux de compression du piston.
En cas de remplacement du vilebrequin ou du bloc moteur, pour déterminer la catégorie de compression, faire un relevé des cotes d'écartement entre l'arête supérieure du maneton au PMH et le plan de joint de culasse. Voir chapitre 4.

Pour les **moteurs BF** il n'est pas nécessaire d'effectuer un relevé de mesures pour déterminer la catégorie de compression du fait que l'on utilise exclusivement des pistons d'un niveau de compression hKH A = **55,17 mm** pour les moteurs BFL et hKH A = **51,67 mm** pour les moteurs BFM.

Español

8. Montar los aros de pistón.

Nota: Desplazar el corte del muelle del aro achaflanado ranurado de aceite por **180**° con respecto al corte del aro.

Nota: En los **motores FL** están incorporados, de serie, pistones con las alturas de compresión

hKH A = **55,17**
hKH B = **55,27**
hKH C = **55,37**

y en los **motores FM**, pistones con las alturas de compresión

hKH A = **51,67**
hKH B = **51,77**
hKH C = **51,87**

Las variantes de pistón se identifican en la cabeza del pistón.
A cada cambio de un pistón debe cuidarse de que el pistón montado tenga la misma clase de altura de compresión.
Cada vez que se cambie el bloque de cilindros o el cigüeñal, es necesario, para la determinación de la clase de altura de compresión de los pistones. medir nuevamente la distancia entre „el canto superior de la muñequilla a PMS y la superficie de asiento de la junta de culata„.
Ver capítulo 4.

En los **motores BF** no hace falta efectuar la medición para la determinación de la clase de altura de compresión de los pistones, dado que en los motores BFL están montados exclusivamente pistones con la altura de compresión hKH A = **55,17 mm** y en los motores BFM, pistones con la altura de compresión hKH A = **51,67 mm**.

Deutsch

8. Kolbenringe montieren.

Hinweis: Federstoß des Dachfasenringes um **180°** zum Ringstoß versetzen.

Hinweis: Bei **FL-Motoren** sind in der Serie Kolben mit den Kompressionshöhen

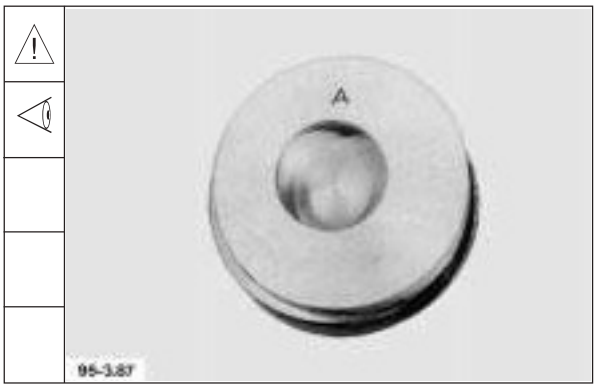
hKH A = **55,17 mm**
hKH B = **55,27 mm**
hKH C = **55,37 mm**

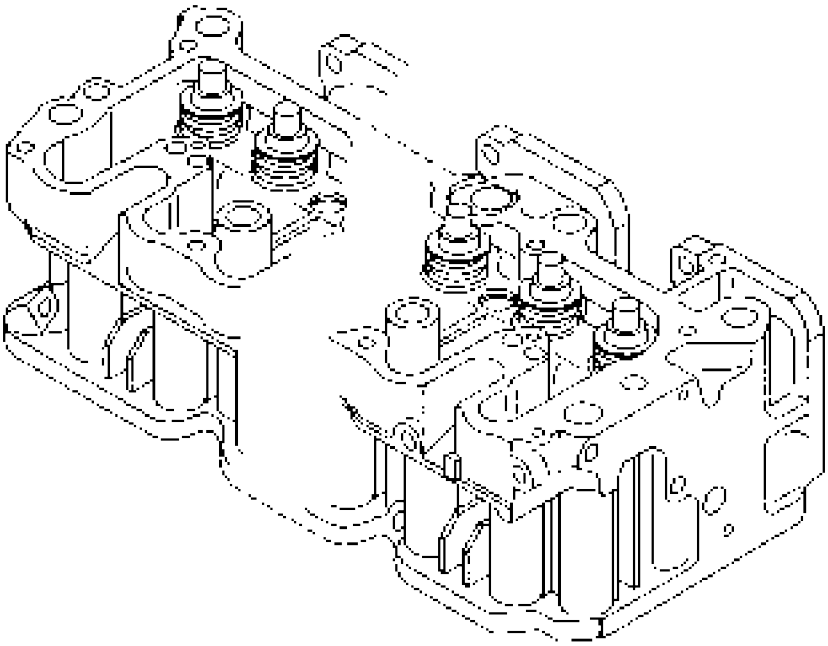
und bei **FM-Motoren** Kolben mit den Kompressionshöhen

hKH A = **51,67 mm**
hKH B = **51,77 mm**
hKH C = **51,87 mm**

eingebaut.
Die Kolbenvarianten sind auf dem Kolbenboden gekennzeichnet.
Bei jedem Kolbentausch ist sicherzustellen, daß die gleiche Kolbenkompressions-Höhenklasse wieder verwendet wird.
Bei Kurbelwellen- oder Zylinderkurbelgehäusetausch muß zur Bestimmung der Kolbenkompressions-Höhenklasse der Abstand „Hubzapfenoberkante OT bis Zylinderkopfdichtungsauflage“ neu ermittelt werden.
Siehe Kapitel 4.

Bei **BF-Motoren** muß die Messung zur Bestimmung der Kolbenkompressions-Höhenklasse nicht durchgeführt werden, da ausschließlich Kolben mit der Kompressionshöhe hKH A = **55,17 mm** bei BFL-Motoren und hKH A = **51,67 mm** bei BFM-Motoren eingebaut sind.





English

Commercial tools required:

Magnetic measuring stand
Valve spring
assembly lever _____ 210 450
Valve reseating tool

Special tools required:

Clamping stand _____ 120 900
Clamping plate _____ 120 910
Sleeve for fitting
valve stem seal _____ 121 410

1. Mount cylinder head on fixture.

2. Remove cone clamp, valve spring cap, valve springs and valves.

Français

Outillage usuel:

Support magnétique
Levier de montage
pour ressorts de soupape __ 210 450
Appareil d'usinage pour sièges de soupape

Outillage usuel:

Chevalet d'ablocage _____ 120 900
Plaque d'ablocage _____ 120 910
Douille de montage pour
joint de tige de soupape____ 121 410

1. Monter la culasse dans le dispositif.

2. Déposer les clavettes, les coupelles, les ressorts de soupape et les soupapes.

Español

Herramientas comerciales:

Soporte magnético de medición
Palanca de montaje
para resortes de válvula ____ 210 450
Aparato para rectificar
asientos de válvula

Herramientas especiales:

Soporte de fijación_____ 120 900
Placa de fijación_____ 120 910
Manguito de montaje para
juntas de vástago de válvula __ 121 410

1. Montar la culata al dispositivo.

2. Desmontar los semiconos, los platillos de retención de resorte, los resortes de válvula y las válvulas.

Deutsch

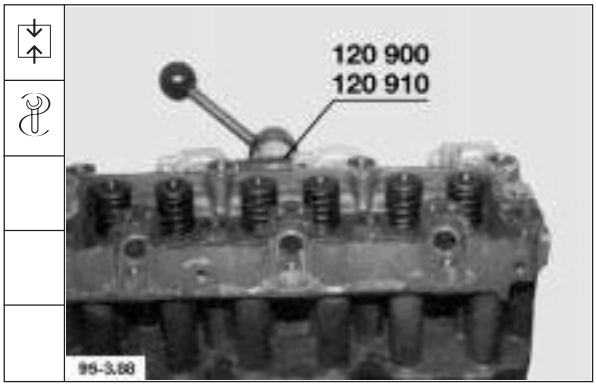
Handelsübliche Werkzeuge:

Magnet-Meßstativ
Ventilfedermontagehebel _____ 210 450
Ventilsitzbearbeitungsgerät

Spezialwerkzeuge:

Aufspannbock _____ 120 900
Aufspannplatte _____ 120 910
Montagehülse für
Ventilschaftabdichtung _____ 121 410

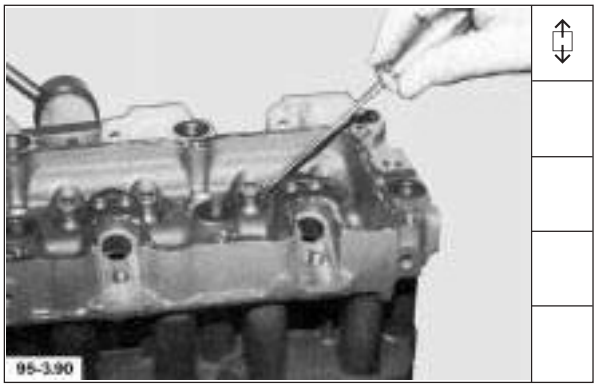
1. Zylinderkopf an Vorrichtung anbauen.



2. Klemmkegel, Ventilfederteller, Ventilfedern und Ventile ausbauen.

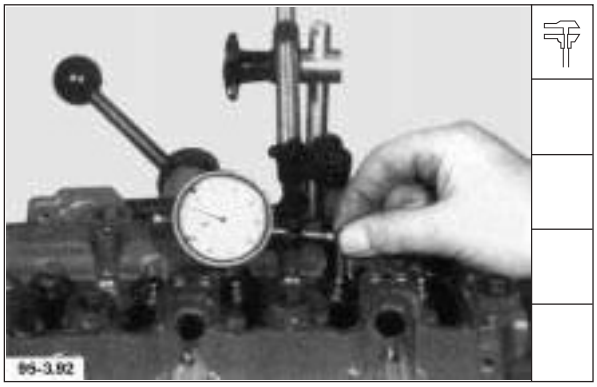
Werkstatthandbuch 1011 F

Deutsch



3. Ventilschaftabdichtung ausbauen.

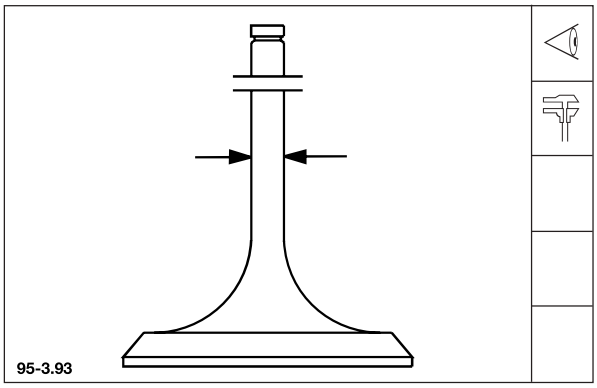
4. Zylinderkopf reinigen und auf Beschädigung prüfen.



5. Ventilschaftspiel messen.

   Verschleißgrenzen:

Einlaßventil	**0,12 mm**
Auslaßventil	**0,15 mm**



6. Ventile sichtprüfen und vermessen.

   Ventilschaftdurchmesser: normal

Einlaßventil	**7,98** $_{-0,015}$ **mm**
Auslaßventil	**7,96** $_{-0,015}$ **mm**

English

3. Remove valve stem seal.

4. Clean cylinder head and inspect for damage.

5. Gauge valve stem clearance.

   Wear limits:

Inlet valve	**0.12 mm**
Exhaust valve	**0.15 mm**

6. Inspect valves and gauge them.

   Valve stem diameter: standard

Inlet valve	**7.98** $_{-0.015}$ **mm**
Exhaust valve	**7.96** $_{-0.015}$ **mm**

Français

3. Déposer le joint de tige de soupape.

4. Nettoyer la culasse et vérifier si elle n'est pas endommagée.

5. Relever le jeu à la tige de soupape.

   Limites d'usure:

Soupape ADM	**0,12 mm**
Soupape ECH	**0,15 mm**

6. Contrôler les soupapes et faire un relevé des cotes.

   Diamètre de la tige de soupape valeur normale

Soupape ADM	**7,98** $_{-0,015}$ **mm**
Soupape ECH	**7,96** $_{-0,015}$ **mm**

Español

3. Retirar la junta del vástago de válvula.

4. Limpiar la culata y examinarla en cuanto a daños.

5. Verificar el juego del vástago de válvula.

   Límites de desgaste:

Válvula de admisión	**0,12 mm**
Válvula de escape	**0,15 mm**

6. Examinar visualmente las válvulas y verificar sus medidas.

   Diámetro de vástago de válvula: normal

Válvula de admisión	**7,98** $_{-0,015}$ **mm**
Válvula de escape	**7,96** $_{-0,015}$ **mm**

English

6.1 Valve rim thickness

Wear limits F 1011 F:

Inlet valve	**0.8 mm**
Exhaust valve	**1.2 mm**

Wear limits BF 1011 F:

Inlet valve	**1.4 mm**
Exhaust valve	**1.2 mm**

6.2 Valve disc diameter

F 1011 F:

Inlet valve	**40.1 ±0.1 mm**
Exhaust valve	**34.9 ±0.1 mm**

BF 1011 F:

Inlet valve	**40.5 ±0.1 mm**
Exhaust valve	**34.9 ±0.1 mm**

7. Inspect valve seat inserts and check wear tolerances.

Valve seat width:

F 1011 F:

Inlet valve	**1.7 ± 0.4 mm**
Exhaust valve	**1.7 ± 0.4 mm**

BF 1011 F:

Inlet valve	**1.58 ± 0.4 mm**
Exhaust valve	**1.7 ± 0.4 mm**

8. Gauge valve clearance between valve disc center and cylinder head sealing surface.

Wear limit, valve penetration into cylinder head

F 1011 F	**1.53 mm**
BF 1011 F	**1.3 mm**

Français

6.1. Epaisseur du bord de soupape:

Limites d'usure moteurs F 1011 F:

Soupape ADM	**0,8 mm**
Soupape ECH	**1,2 mm**

Limites d'usure moteurs BF 1011 F:

Soupape ADM	**1,4 mm**
Soupape ECH	**1,2 mm**

6.2 Diamètre de tête de soupape

F 1011 F:

Soupape ADM	**40,1 ± 0,1 mm**
Soupape ECH	**34,9 ± 0,1 mm**

BF 1011F:

Soupape ADM	**40,5 ± 0,1 mm**
Soupape ECH	**34,9 ± 0,1 mm**

7. Contrôle visuel des sièges rapportés. Vérifier les cotes d'usure.

Largeur du siège moteur:

F 1011 F:

Soupape ADM	**1,7 ± 0,4 mm**
Soupape ECH	**1,7 ± 0,4 mm**

BF 1011 F:

Soupape ADM	**1,58 ± 0,4 mm**
Soupape ECH	**1,7 ± 0,4 mm**

8. Relever le retrait de soupape du centre de la tête de soupape jusqu'au plan de joint de culasse.

Limites d'usure, cote de retrait de soupape

F 1011 F	**1,53 mm**
BF 1011 F	**1,3 mm**

Español

6.1 Espesor de borde de la cabeza de válvula

Límites de desgaste F 1011 F:

Válvula de admisión	**0,8 mm**
Válvula de escape	**1,2 mm**

Límites de desgaste BF 1011 F:

Válvula de admisión	**1,4 mm**
Válvula de escape	**1,2 mm**

6.2 Diámetro de la cabeza de válvula

F 1011 F:

Válvula de admisión	**40,1 ± 0,1 mm**
Válvula de escape	**34,9 ± 0,1 mm**

BF 1011 F:

Válvula de admisión	**40,5 ± 0,1 mm**
Válvula de escape	**34,9 ± 0,1 mm**

7. Examinar visualmente los asientos de válvula postizos. Controlar las medidas de desgaste.

Ancho del asiento postizo:

F 1011 F:

Válvula de admisión	**1,7 ± 0,4 mm**
Válvula de escape	**1,7 ± 0,4 mm**

BF 1011 F:

Válvula de admisión	**1,58 ± 0,4 mm**
Válvula de escape	**1,7 ± 0,4 mm**

8. Medir el retroceso de la válvula desde el centro de la cabeza de válvula hasta la superficie de asiento de la junta de culata.

Límite de desgaste, retroceso de válvula

F 1011 F	**1,53 mm**
BF 1011 F	**1,3 mm**

Deutsch

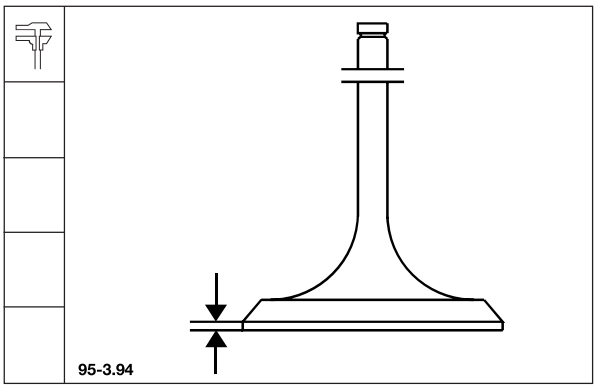
6.1 Ventilrandstärke

Verschleißgrenzen F 1011 F:

Einlaßventil	**0,8 mm**
Auslaßventil	**1,2 mm**

Verschleißgrenzen BF 1011 F:

Einlaßventil	**1,4 mm**
Auslaßventil	**1,2 mm**



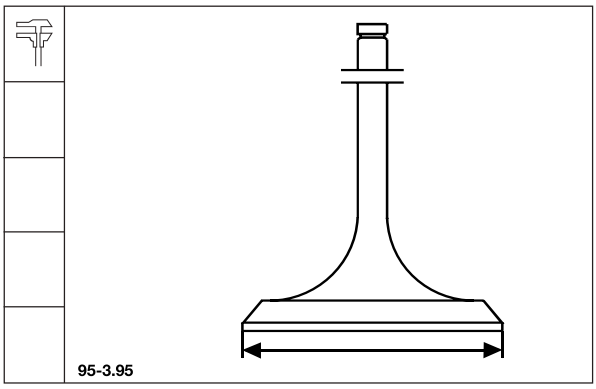
6.2 Ventiltellerdurchmesser

F 1011 F:

Einlaßventil	**40,1 ± 0,1 mm**
Auslaßventil	**34,9 ± 0,1 mm**

BF 1011 F:

Einlaßventil	**40,5 ± 0,1 mm**
Auslaßventil	**34,9 ± 0,1 mm**



7. Ventilsitzringe sichtprüfen. Verschleißmaße kontrollieren.

Ventilsitzbreite:

F 1011 F

Einlaßventil	**1,7 ± 0,4 mm**
Auslaßventil	**1,7 ± 0,4 mm**

BF 1011 F

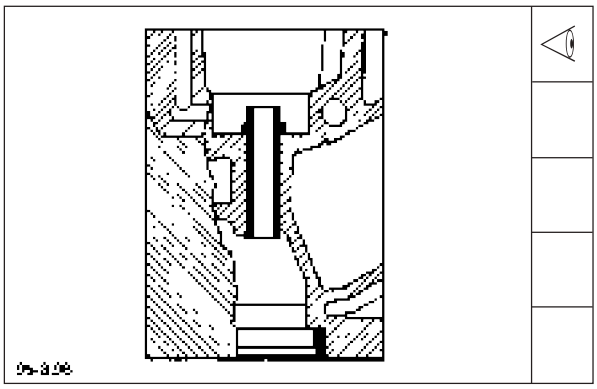
Einlaßventil	**1,58 ± 0,4 mm**
Auslaßventil	**1,7 ± 0,4 mm**

8. Ventilrückstand von der Mitte, Ventilteller zur Zylinderkopfdichtfläche messen.

Verschleißgrenze, Ventilrückstehmaß

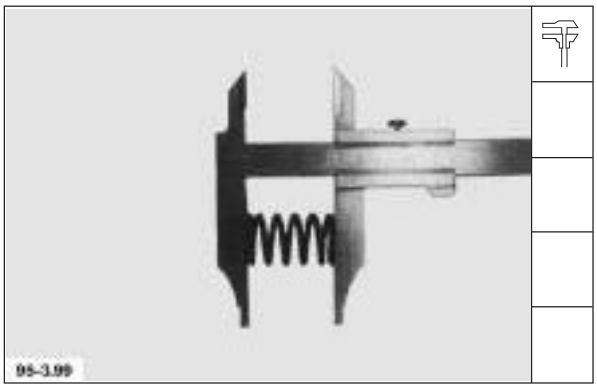
F 1011 F	**1,53 mm**
BF 1011 F	**1,3 mm**

Werkstatthandbuch 1011 F



Deutsch

8.1 Bei verschlissenen Ventilsitzringen, Ventilführungen oder beschädigter Zylinderkopfdichtfläche besteht die Möglichkeit den Zylin-derkopf in unseren Service-Centern instand setzen zu lassen.

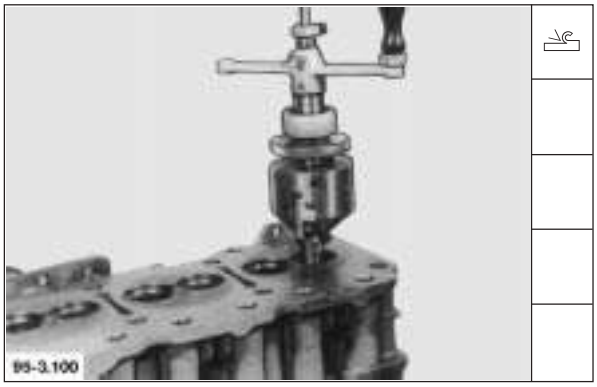


9. Länge der Ventilfeder messen.

Länge ungespannt normal:

Ventilfeder Draht- ø 3,35 mm	**38,9 mm**
oder	
Ventilfeder Draht- ø 3,40 mm	**39,3 mm**

Ein gemischter Einbau ist zulässig.



10. Korrekturen der Ventilsitzbreite und Ventilfreistellung mit Ventilsitz-Bearbeitungsgerät durchführen.

10.1 Ventilsitzringbearbeitung

Ventilsitzwinkel	Einlaß	Auslaß
F 1011 F	**45°**	**45°**
BF 1011 F	**30°**	**45°**
Ventilsitzbreite:		
F 1011 F	**1,7 ± 0,4 mm**	
BF 1011 F	**1,58 ± 0,4**	**1,7 ± 0,4**

Hinweis: Nach Ventilsitzringbearbeitung nochmals Ventilrückstand messen.

English

8.1 If valve seats, valve guides are worn out or cylinder head sealing surface is damaged, it is possible to have the cylinder head reconditioned in our Service Centers.

9. Gauge length of valve spring.

Unloaded length, standard:

Valve spring
wire dia. 3.35 mm **38.9 mm**
or
Valve spring
wire dia. 3.40 mm **39.3 mm**

Mixed installation is permissible.

10. Correct seat width and relief using valve reseating tool.

10.1 Reworking valve seat insert

Valve seat angle	Inlet	Exhaust
F 1011 F	**45°**	**45°**
BF 1011 F	**30°**	**45°**

Valve seat width:		
F 1011 F	**1.7 ± 0.4 mm**	
BF 1011 F	**1.58 ± 0.4**	**1.7 ± 0.4**

Note: Measure valve penetration into cylinder head once again after reworking of valve seat insert.

Français

8.1 Quand les sièges de soupape ou les guides de soupape sont usés et que le plan d'appui de culasse est endommagé, il est possible de remettre en état la culasse dans l'un de nos points de service après-vente.

9. Relever les cotes de longueur du ressort de soupape.

Longueur normale non tendue

fil ressort
de soupape Ø 3,35 mm **38,9 mm**
ou
fil ressort
de soupape Ø 3,40 mm **39,3 mm**

Un montage mixte est admis.

10. Effectuer les corrections de la largeur de portée du siège de soupape et le dégagement de soupape avec l'appareil d'usinage de siège de soupape.

10.1 Usinage du siège de soupape

Angle du siège de soupape	ADM	ECH
F 1011 F	**45°**	**45°**
BF 1011 F	**30°**	**45°**

Largeur de portée du siège de soupape	ADM	ECH
F 1011 F	**1,7 ± 0,4 mm**	
BF 1011 F	**1,58 ± 0,4**	**1,7 ± 0,4**

Nota: après usinage du siège de soupape faire un nouveau relevé du retrait de soupape.

Español

8.1 Si los asientos postizos o guías de las válvulas están desgastados o si la superficie de asiento de la junta de culata está dañada, existe la posibilidad de hacer reparar la culata en uno de nuestos Centros de Servicio.

9. Verificar la longitud de los resortes de válvula.

Longitud normal en estado no tensado:

Resorte de válvula
- Ø de alambre 3,35 mm **38,9 mm**
ó
Ø de alambre 3,40 mm **39,3 mm**

Se admiten montajes mixtos.

10. Realizar correcciones en el ancho del asiento de válvula y en el destalonado de la válvula mediante el aparato para rectificar asientos de válvula.

10.1 Rectificado de asientos postizos de válvula

Angulo asiento	Admisión	Escape
F 1011 F	**45°**	**45°**
BF 1011 F	**30°**	**45°**

Ancho asiento de válvula:		
F 1011 F	**1,7 ± 0,4 mm**	
BF 1011 F	**1,58 ± 0,4**	**1,7 ± 0,4**

Nota: Verificar de nuevo el retroceso de la válvula después del rectificado del asiento postizo de la misma.

English

11. Insert and retain valve. Slide protective sleeve onto valve stem.

Note: Before fitting valve stem seal, valve splines must be covered by the protective sleeve or masking tape.

12. Slide valve stem seal onto protective sleeve.

13. Remove protective sleeve. Press in valve stem seal as far as it will go.

14. Assemble cylinder head:
Position valve spring and valve spring cap.

Français

11. Mettre en place et maintenir la soupape. Insérer la douille de protection sur la tige de soupape.

Nota: avant chaque montage du joint de tige de soupape recouvrir les rainures de clavette d'une douille de protection ou d'une feuille collante.

12. Insérer la douille de protection sur le joint de tige de soupape.

13. Oter la douille de protection. Enfoncer le joint de la tige de soupape jusqu'en position de butée.

14. Compléter l'assemblage de la culasse en montant les ressorts de soupape et les coupelles de ressort.

Español

11. Introducir la válvula y retenerla. Colocar el manguito protector sobre el vástago de la válvula.

Nota: Antes de montar la junta en el vástago de válvula es siempre necesario cubrir las ranuras de chaveta de válvula mediante el manguito protector o una lámina adhesiva.

12. Colocar la junta de vástago de válvula, pasándola por encima del manguito protector.

13. Quitar el manguito protector. Introducir a presión la junta hasta el tope.

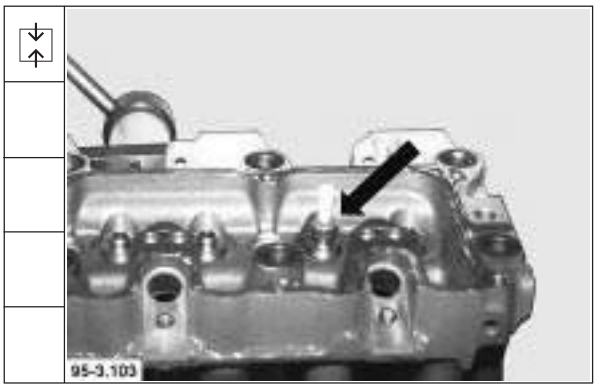
14. Completar la culata:
Colocar el resorte de válvula y su platillo de retención.

Deutsch

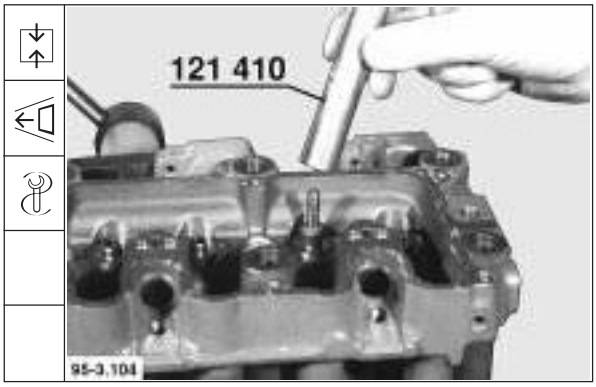
11. Ventil einsetzen und gegenhalten. Schutzhülse auf den Ventilschaft stecken.

Hinweis: Vor jeder Montage der Ventilschaftabdichtung sind die Ventil-Keilnuten mit der Schutzhülse oder einer Klebefolie abzudecken.

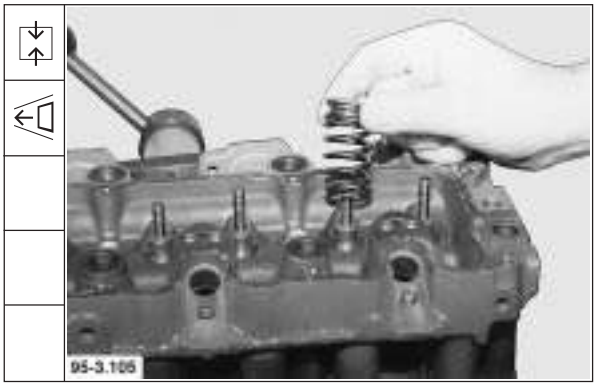
12. Ventilschaftabdichtung über die Schutzhülse schieben.



13. Schutzhülse entfernen. Ventilschaftabdichtung bis Anschlag eindrücken.



14. Zylinderkopf komplettieren:
Ventilfeder und Ventilfederteller aufsetzen.



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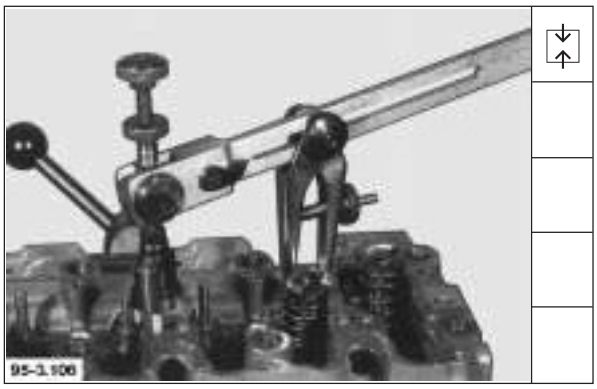


Deutsch

15. Ventilfedermontagehebel aufbauen, Klemmkegel einsetzen.

English

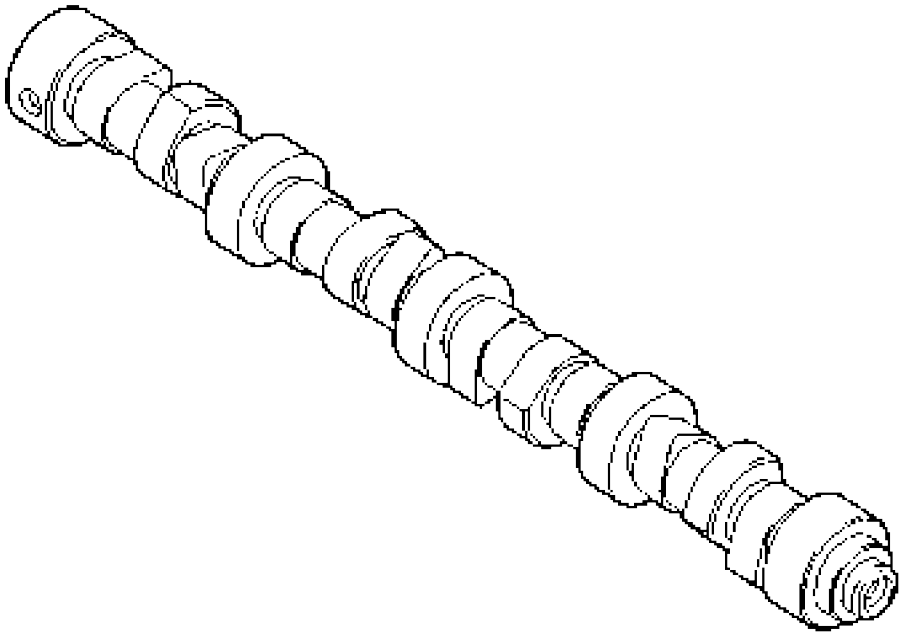
15. Fit valve assembly lever, insert cone clamp.

Français

15. Mettre en place le levier de montage des ressorts de soupape ainsi que les clavettes demi-cône.

Español

15. Montar la palanca de montaje para resortes de válvula e introducir los semiconos.



English

1. Inspect cams and bearing journals for wear.

Français

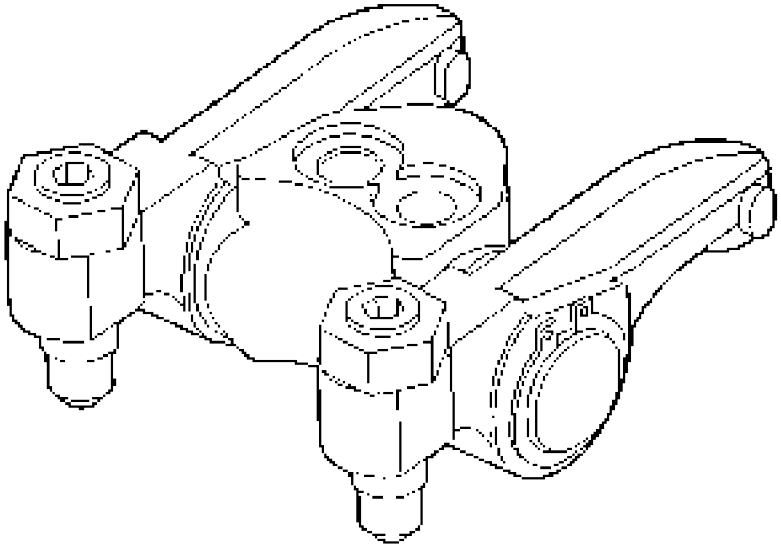
1. Contrôle visuel de l'usure des cames et tourillons.

Español

1. Examinar visualmente las levas y los muñones de apoyo en cuanto a desgaste.

Deutsch

1. Nocken und Lagerzapfen auf Verschleiß sichtprüfen



English

1. Dismantle rocker arm bracket.

2. Check for wear and replace if necessary:
   Journals
   Adjusting screw
   Rocker arm contact face
   Bore

3. Check oil duct for free passage.

4. Reassemble rocker arm bracket.
   Fit circlips.

Français

1. Démonter le support de culbuteurs.

2 Contrôle de l'usure et au besoin remplacement
   des tourillons,
   de la vis de réglage,
   de la surface de frottement des culbuteurs
   et de l'alésage.

3. Vérifier le libre passage des conduits de graissage.

4. Compléter l'assemblage du support de culbuteurs. Monter les circlips.

Español

1. Desarmar el soporte de balancines.

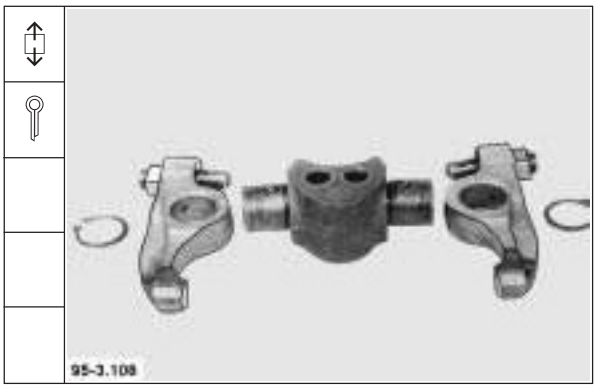
2. Examinar en cuanto a desgaste y reemplazar, si es necesario:
   los muñones de apoyo,
   el tornillo de reglaje,
   la superficie de deslizamiento del balancín y
   el alojamiento.

3. Comprobar si el conducto de aceite está despejado.

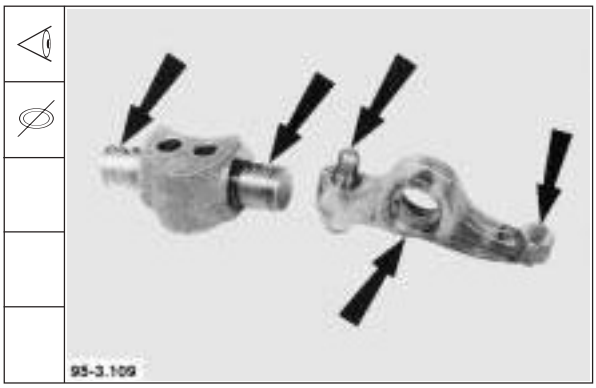
4. Completar el soporte de balancines.
   Montar los anillos de retención.

Deutsch

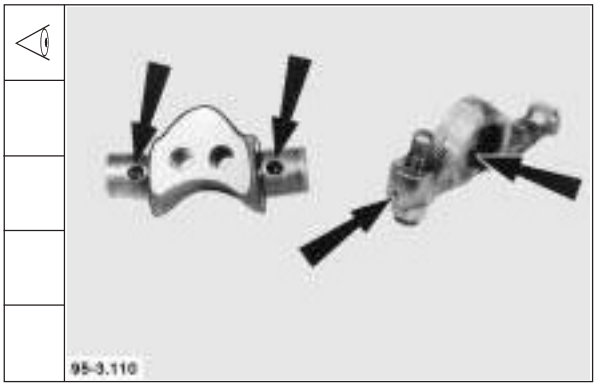
1. Kipphebelbock zerlegen.



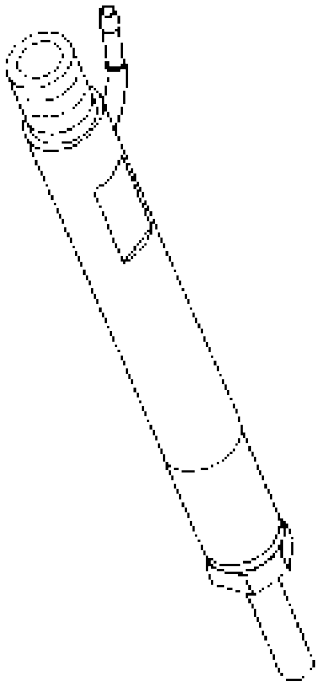
2. Auf Verschleiß prüfen ggf. austauschen:
   Lagerzapfen
   Einstellschraube
   Kipphebelgleitfläche
   Bohrung



3. Ölkanal auf Durchgang prüfen.



4. Kipphebelbock komplettieren. Sicherungsringe montieren.



English

Commercial tool required:
Long socket a/flats 15 _____ 8021

Special tool required:
Retainer
for injector _____ 110 110

1. Unscrew cap nut.

2. Sequence of parts disassembly:

   1. Cap nut
   2. Injection nozzle
   3. Adapter
   4. Thrust pin
   5. Compression spring
   6. Shims

Wash all parts in clean diesel fuel and blow out with compressed air.

3. Nozzle needle and nozzle body are lapped together and may neither be confused nor exchanged individually. Do not touch nozzle needles with your fingers. When nozzle body is held in upright position, nozzle needle should by its own weight slide down slowly and smoothly on its seating.

Note: If nozzle needle does not slide down smoothly, wash injection nozzle again in diesel fuel. Renew, if necessary. New injection nozzle must likewise be washed in clean diesel fuel.

Français

Outillage usuel:
Clé à douille longue de 15 _____ 8021

Outillage spécial :
Dispositif d'immobilisation pour
injecteur _____ 110 110

1. Dévisser l'écrou-raccord.

2. Ordre de démontage des pièces

   1. Ecrou-raccord
   2. Injecteur
   3. Pièce intermédiaire
   4. Tige poussoir
   5. Ressort de pression
   6. Rondelles d'épaisseur

Nettoyer toutes les pièces dans du combustible Diesel et les sécher au jet d'air comprimé.

3. L'aiguille et la buse de l'injecteur sont appariées et rodées ensemble, elles ne doivent pas être interverties ni changées séparément. Ne pas prendre l'aiguille avec les doigts. L'injecteur étant tenu verticalement l'aiguille doit retomber d'elle-même lentement dans son logement.

Nota: Si l'aiguille de l'injecteur ne glisse pas librement dans son logement la laver une nouvelle fois, si nécessaire renouveller l'injecteur.
Penser à laver tout injecteur neuf dans du gazole propre.

Español

Herramientas comerciales:
Llave de vaso largo de 15 _____ 8021

Herramienta especial:
Soporte
de inyectores _____ 110 110

1. Desenroscar la tuerca de unión.

2. Secuencia del despiece de componentes:

   1. Tuercas de unión
   2. Inyector
   3. Pieza intermedia
   4. Perno de presión
   5. Muelle de presión
   6. Arandelas de reglaje

Lavar todas las piezas en combustible diesel limpio y soplarlas con aire comprimido.

3. El cuerpo y la aguja del inyector son piezas perfectamente hermanadas por lapeado y, por tanto, no está permitido emparejarlas con otras o cambiarlas individualmente. No tocar la aguja con los dedos. Con el cuerpo del inyector en posición vertical, la aguja debe bajar por su propio peso lenta y progresivamente, deslizándose hasta alcanzar su posición final de asiento.

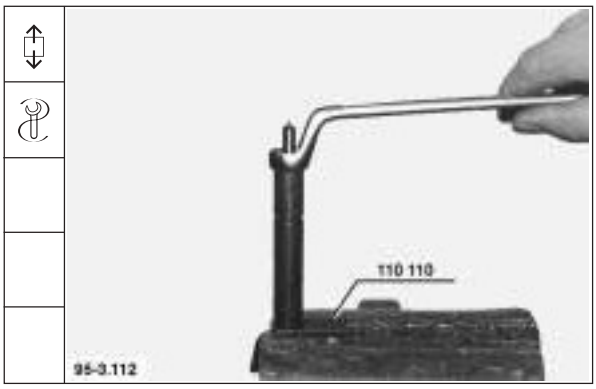
Nota: Si el deslizamiento de la aguja no es progresivo, el inyector debe lavarse otra vez en combustible diesel o cambiarse por otro nuevo, según el caso. Lavar el inyector nuevo igualmente en combustible diesel limpio.

Deutsch

Handelsübliches Werkzeug:
Lange Stecknuß SW 15 _____ 8021

Spezialwerkzeug:
Halter für Einspritzventil _____ 110 110

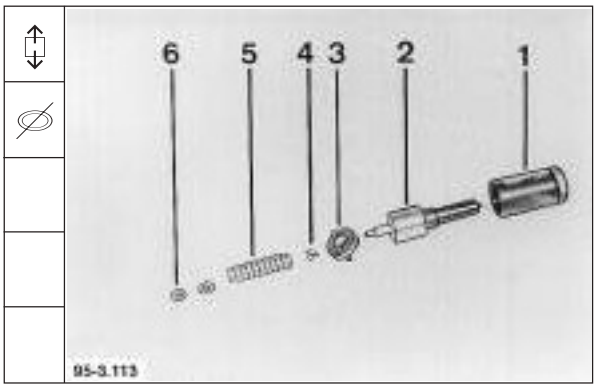
1. Überwurfmutter abschrauben.



2. Folge der Einzeldemontage

   1. Überwurfmutter
   2. Einspritzdüse
   3. Zwischenstück
   4. Druckbolzen
   5. Druckfeder
   6. Ausgleichscheiben

Sämtliche Teile in sauberem Dieselkraftstoff reinigen und mit Druckluft ausblasen.



3. Düsennadel und Düsenkörper sind zusammen geläppt und dürfen weder vertauscht noch einzeln ausgetauscht werden.
   Düsennadel nicht mit den Fingern berühren.
   Die Düsennadel muß bei senkrecht gehaltenem Düsenkörper durch ihr Eigengewicht langsam und ruckfrei auf ihren Sitz gleiten.

Hinweis: Bei ruckweisem Abgleiten der Düsennadel die Einspritzdüse erneut in Dieselkraftstoff auswaschen, bei Bedarf erneuern.
Neue Einspritzdüse ebenfalls in sauberem Dieselkraftstoff reinigen.

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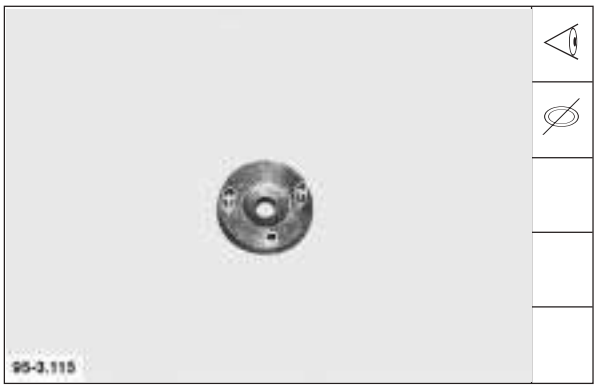
Deutsch



4. Sitzflächen des Zwischenstückes auf Verschleiß prüfen. Auf Vorhandensein der Zentrierstifte achten.

5. Ausgleichscheiben einsetzen.

Hinweis: Der Abspritzdruck ist von den Ausgleichscheiben abhängig.

6. Druckfeder einsetzen.

7. Druckbolzen mit dem Zentrierbund zur Druckfeder weisend einsetzen.

English

4. Check seating faces of adapter for wear. Make sure that centering pins are fitted.

5. Insert shims.

Note: The ejection pressure is dependent on the shims.

6. Insert compression spring.

7. Insert thrust pin with centering collar facing towards compression spring.

Français

4. Vérifier l'usure des surfaces portantes de la pièce intermédiaire. Veiller à ce que les pions de centrage soient bien en place.

5. Intercaler des rondelles d'épaisseur.

Nota: la pression de tarage dépend des rondelles d'épaisseur.

6. Placer le ressort de pression.

7. Placer la tige poussoir en orientant la collerette de centrage vers le ressort.

Español

4. Examinar las superficies de asiento de la pieza intermedia en cuanto a desgaste. Prestar atención a la existencia de las espigas de centraje.

5. Colocar las arandelas de reglaje.

Nota: La presión de descarga depende de las arandelas de reglaje.

6. Introducir el muelle de presión.

7. Colocar el perno de presión con el collarín de centraje indicando hacia el muelle de presión.

English

8. Insert adapter with centering pins into the bores of the nozzle holder.

Note: The spot facing points to the thrust pin.

9. Fit injection nozzle with center bores mating with the centering pins of the adapter.

Note: Take care that nozzle needle does not fall out of nozzle body.

10. Screw on cap nut.

11. Tighten cap nut.

Tightening specification: **45 ± 5 Nm**

For testing and adjusting injector see Chapter 2.

Français

8. Placer la pièce intermédiaire avec les pions de centrage dans les alésages du porte-injecteur.

Nota: le lamage doit être orienté vers la tige poussoir.

9. Placer l'injecteur avec les alésages de centrage sur les pions de centrage de la pièce intermédiaire.

Nota: ne pas faire tomber l'aiguille de l'injecteur.

10. Visser la vis raccord.

11. Bloquer la vis-raccord.

Consigne de serrage: **45 ± 5 Nm**

Pour vérifier et caler l'injecteur, voir chapitre 2.

Español

8. Introducir la pieza intermedia con las espigas de centraje en los taladros del portainyector.

Nota: El rebaje debe indicar hacia el perno de presión.

9. Asentar el inyector con los taladros de centraje sobre las espigas de centraje de la pieza intermedia.

Nota: La aguja no debe caer fuera del cuerpo del inyector.

10. Enroscar la tuerca de unión.

11. Apretar la tuerca de unión.

Prescripción de apriete: **45 ± 5 Nm**

Para la verificación y el ajuste del inyector, ver cap. 2.

Deutsch

8. Zwischenstück mit den Zentrierstiften in die Bohrungen des Düsenhalters einsetzen.

Hinweis: Die Ansenkung weist zum Druckbolzen.

9. Einspritzdüse mit den Zentrierbohrungen auf die Zentrierstifte des Zwischenstückes aufsetzen.

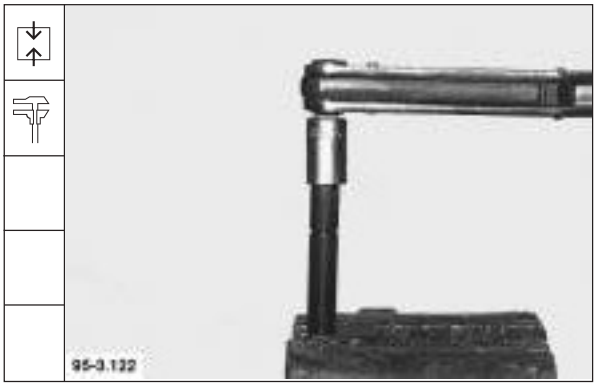
Hinweis: Die Düsennadel darf nicht aus dem Düsenkörper fallen.

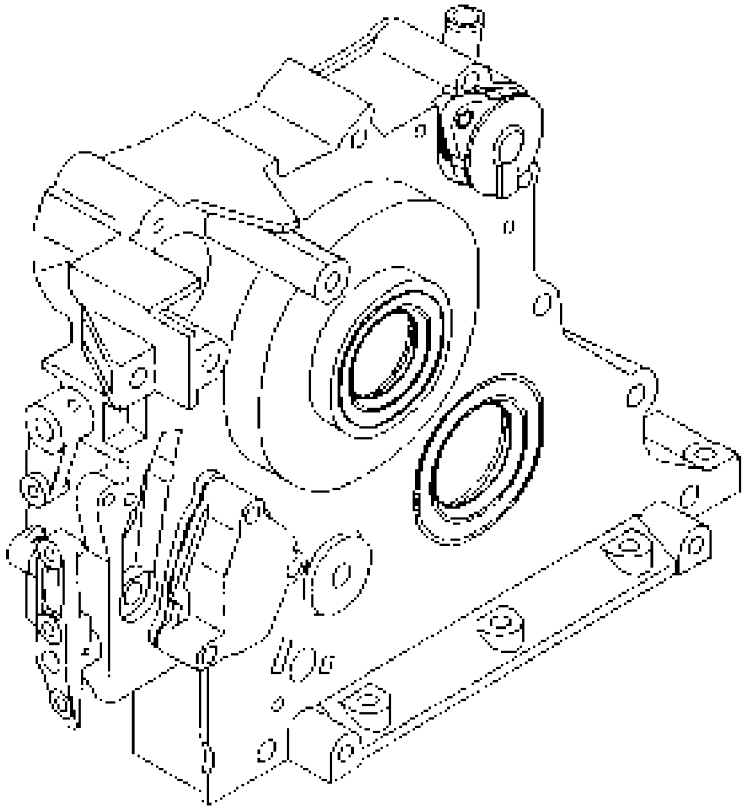
10. Überwurfmutter aufschrauben.

11. Überwurfmutter festdrehen.

Anziehvorschrift: **45 ± 5 Nm**

Einspritzventil prüfen und einstellen, siehe Kapitel 2.





English

Special tools required:

Assembly tool _____ 142 850
Assembly tool _____ 142 050
Measuring device for governor shaft and piston protrusion _____ 100 750

1. Remove engine shutdown device, if any.
2. Detach governor spring.
3. Remove governor lever shaft.

Français

Outillage spécial:

Dispositif de montage _____ 142 850
Dispositif de montage _____ 142 050
Règle de mesure pour arbre du régulateur et dépassement de piston ____ 100 750

1. Si le moteur en est équipé d'un déposer le dispositif d'arrêt.
2. Décrocher le ressort du régulateur.
3. Déposer l'arbre du levier du régulateur.

Español

Herramientas especiales:

Dispositivo de montaje ____ 142 850
Dispositivo de montaje ____ 142 050
Aparato de medición para el eje del regulador y saliente de pistón_____ 100 750

1. Si existe, desmontar el dispositivo de parada del motor.
2. Descolgar el resorte regulador.
3. Desmontar el eje de palanca de regulador.

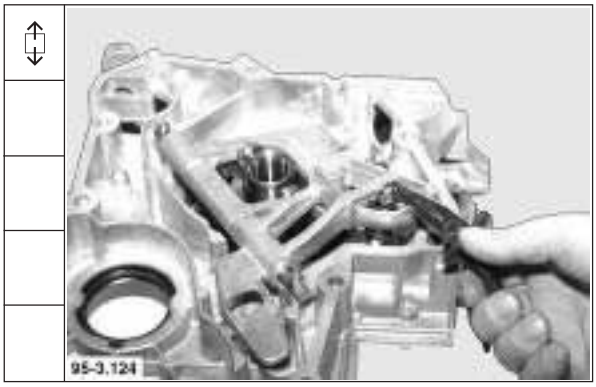
Deutsch

Spezialwerkzeug:

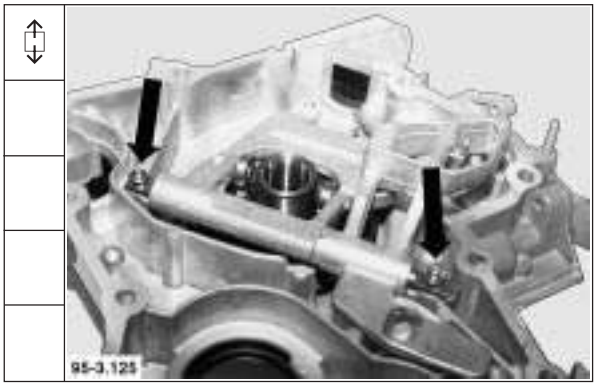
Montagevorrichtung _____ 142 850
Montagevorrichtung _____ 142 050
Meßgerät für Reglerwelle
und Kolbenüberstand _____ 100 750

1. Falls vorhanden, Motorabstellung abbauen.

2. Reglerfeder aushängen.



3. Reglerhebelwelle abbauen.



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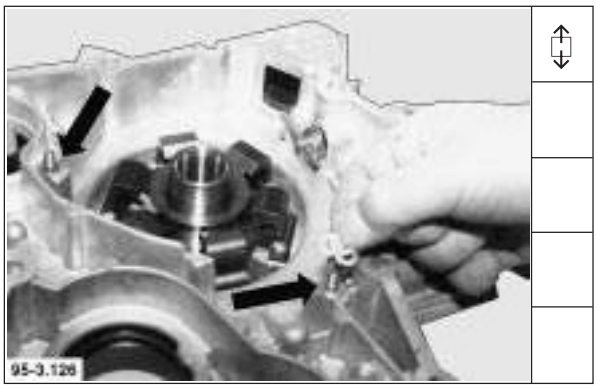
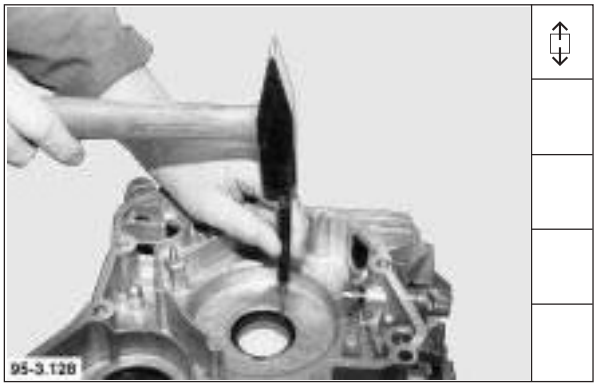
Deutsch

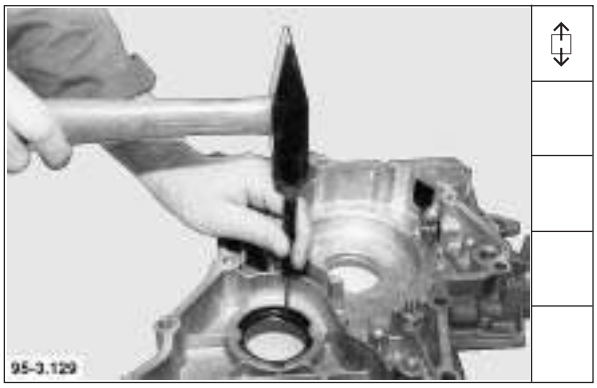


4. Ausgleichsscheiben unter der Reglerhebelwelle abnehmen.

5. Fliehkraftregler herausnehmen.



6. Wellendichtring für Nockenwelle austreiben.



7. Wellendichtring für Kurbelwelle austreiben.

English

4. Take off shims below governor lever shaft.
5. Remove centrifugal governor.
6. Drive out camshaft seal.
7. Drive out crankshaft seal.

Français

4. Retirer les cales de réglage se trouvant sous l'arbre du régulateur.
5. Retirer le régulateur centrifuge.
6. Chasser le joint d'arbre à cames.
7. Chasser le joint d'arbre du vilebrequin.

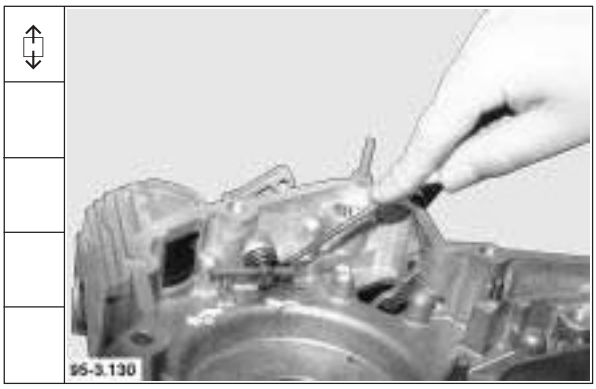
Español

4. Sacar las arandelas de ajuste por debajo del eje de palanca de regulador.
5. Retirar el regulador centrífugo.
6. Desmontar golpeando el retén para el eje de levas.
7. Desmontar golpeando el retén para el cigüeñal

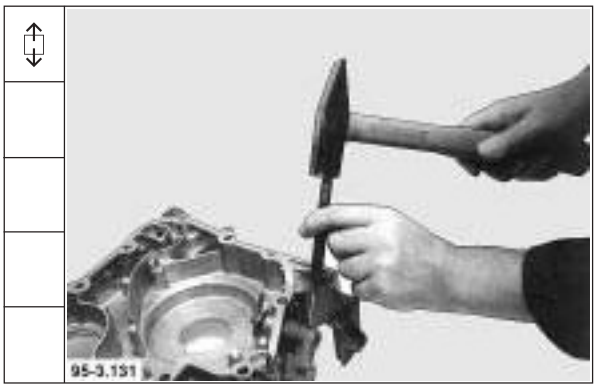
English	Français	Español
8. Detach spring.	8. Décrocher le ressort.	8. Descolgar el resorte.
9. Drive out dowel sleeve.	9. Chasser la douille de serrage.	9. Desmontar golpeando el casquillo de sujeción.
10. Remove shutdown lever together with spacer bushes.	10. Retirer le levier d'arrêt avec les douilles d'écartement.	10. Retirar la palanca de parada con los casquillos distanciadores.
11. Remove shaft together with spacer bush and spring.	11. Oter l'arbre avec la douille d'écartement et le ressort.	11. Retirar el eje con el casquillo distanciador y resorte.

Deutsch

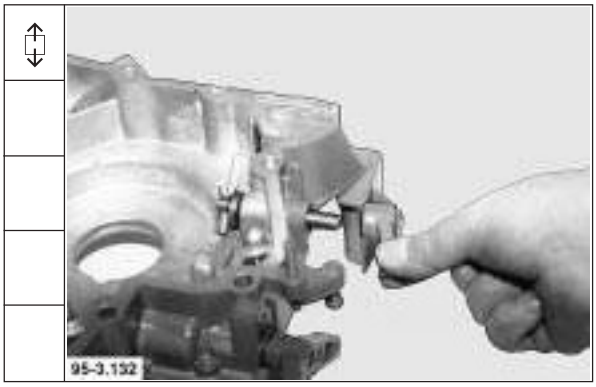
8. Feder aushängen.



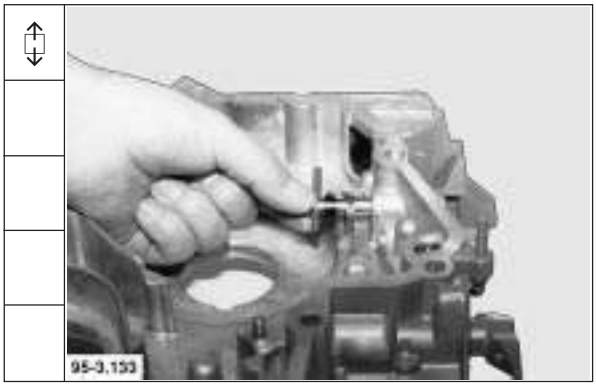
9. Spannhülse austreiben.



10. Abstellhebel mit Abstandsbuchsen herausnehmen.



11. Welle mit Abstandsbuchse und Feder herausnehmen.



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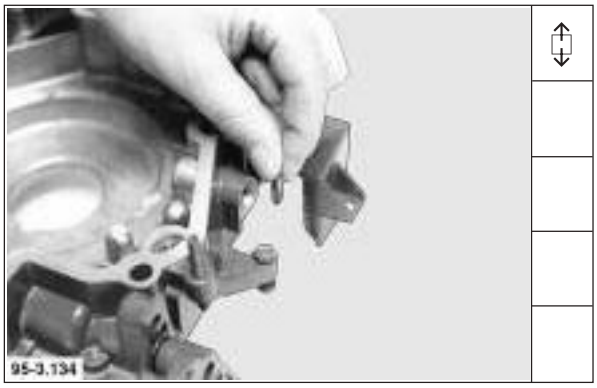
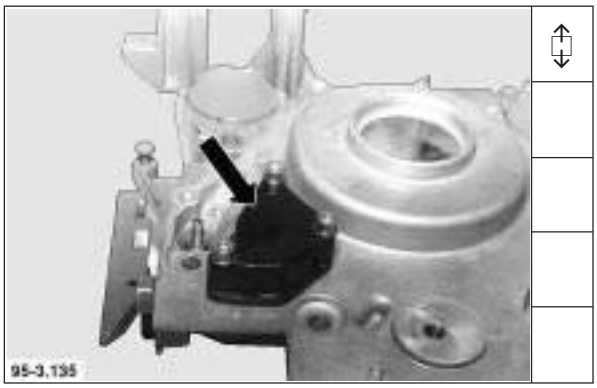
Deutsch



12. Runddichtring herausnehmen.



13. Verschlußdeckel abbauen.

14. Spannhülse austreiben.

15. Bolzen heraushebeln.

Hinweis: Dichtfläche nicht beschädigen.

English

12. Take out O-seal.

13. Remove cover.

14. Drive out dowel sleeve.

15. Lever out pin.

Note: Make sure not to damage sealing surface.

Français

12. Retirer le joint torique.

13. Déposer le couvercle.

14. Chasser la douille de serrage.

15. Décoller le boulon.

Nota: ne pas endommager le plan d'appui.

Español

12. Quitar el anillo tórico.

13. Desmontar la tapa de cierre.

14. Desmontar golpeando el casquillo de sujeción.

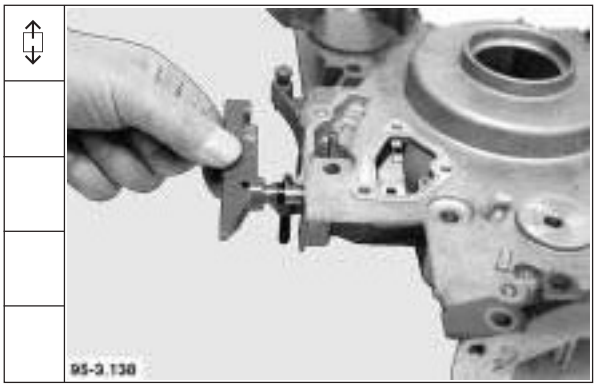
15. Sacar el perno, haciendo palanca.

Nota: Cuidar de no dañar la superficie de cierre.

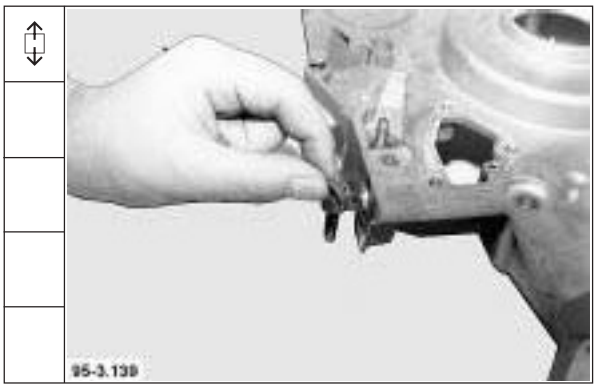
English	Français	Español
16. Remove speed control lever together with spacer bush.	16. Retirer le levier de réglage de vitesse avec la douille d'écartement.	16. Retirar la palanca de ajuste de velocidad con el casquillo distanciador.
17. Take out O-seal.	17. Retirer le joint torique.	17. Quitar el anillo tórico.
18. Remove full-load stop.	18. Déposer la butée de pleine charge.	18. Desmontar el tope de plena carga.
19. Remove clamping pad, if any. Unscrew torque control.	19. Si le moteur en est équipé d'une, ôter la patte de serrage. Retirer le correcteur de débit.	19. Si existe, quitar la garra de sujeción. Desenroscar el mecanismo corrector de par.

Deutsch

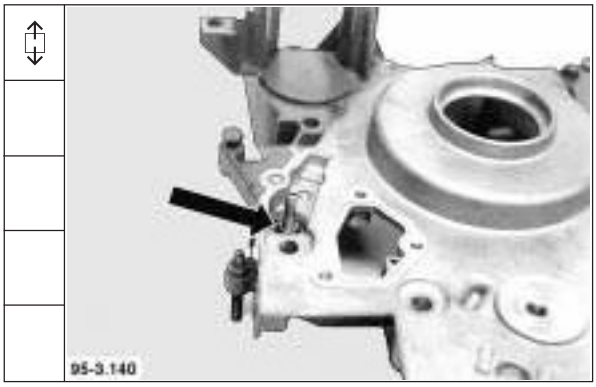
16. Drehzahlverstellhebel mit Abstandsbuchse herausnehmen.



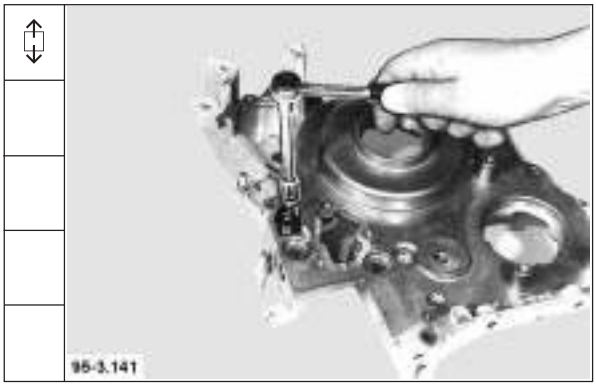
17. Runddichtring herausnehmen.



18. Vollastanschlag ausbauen.



19. Falls vorhanden, Spannpratze entfernen. Angleichung herausschrauben.



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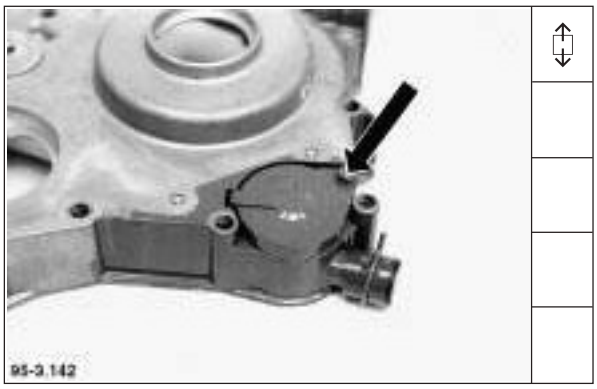
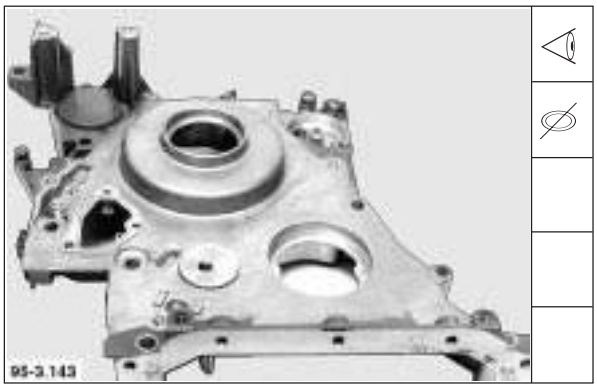
Deutsch

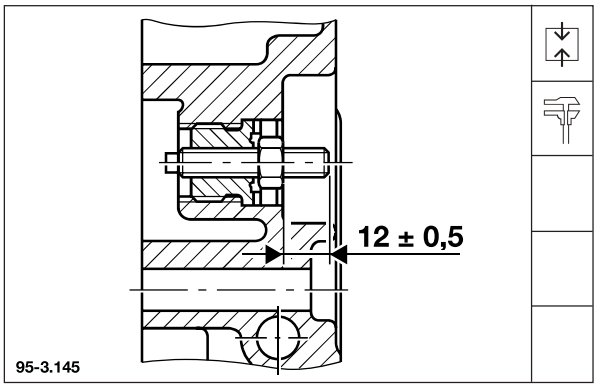


20. Entlüftungsventil ausbauen.



21. Vorderen Deckel sichtprüfen ggf. austauschen.

22. Vollastanschlag mit Dichtring einbauen.



23. Abstand der Vollastanschlagschraube einstellen. Kontermutter festdrehen.

    Anziehvorschrift: **4,5 Nm**

3

English

20. Remove vent valve.

21. Inspect front cover and replace if necessary.

22. Install full-load stop together with O-seal.

23. Adjust distance of full-load stop screw. Tighten locknut.

    Tightening specification: **4.5 Nm**

Français

20. Déposer la vanne de purge.

21. Contrôler visuellement le couvercle avant, au besoin le remplacer.

22. Monter la butée de pleine charge avec la bague d'étanchéité.

23. Régler l'espace de la vis de pleine charge. Bloquer le contre-écrou.

    Consigne de serrage: **4,5 Nm**

Español

20. Desmontar la válvula de purga de aire.

21. Examinar visualmente la tapa delantera, sustituyéndola en caso necesario.

22. Montar el tope de plena carga con la junta anular.

23. Ajustar la distancia del tornillo de tope de plena carga. Apretar la contratuerca.

    Prescripción de apriete: **4,5 Nm**

English

24. Inspect individual components of torque control, if any, and replace if necessary.

25. Preassemble torque control.
Turn item 1 as far as it will go into item 2. Then unsrew by **1 + 0.5** turns.
Tighten item 3.

Tightening specification: **16 ± 1.6 Nm**

26. Turn item 4 as far as it will go into item 5. Then unscrew by **1 turn.**
Tighten item 6.

Tightening specification: **6 ± 0.6 Nm**

27. Turn in torque control.

Français

24. Contrôler visuellement les diverses pièces du correcteur de débit, au besoin les remplacer.

25. Préassembler le correction de débit.
Insérer jusqu'en position de butée le repère 1 dans le repère 2.
Ensuite desserrer d'un tour et demi.
Bloquer le repère 3.

Consigne de serrage **16 ± 1,6 Nm**

26. Insérer rep. 4 jusqu'en butée de rep. 5. Ensuite dévisser **d'un tour.**
Serrer ensuite rep. 6.

Consigne de serrage: **6 ± 0,6 Nm**

27. Monter et visser le correcteur de débit.

Español

24. Si existen, examinar visualmente los componentes del mecanismo corrector de par, sustituyéndolos en caso necesario.

25. Prearmar el mecanismo corrector de par.
Enroscar la pieza 1 en la pieza 2 hasta el tope. A continuación, desenroscaria una vuelta y media.
Apretar la pieza 3.

Prescripción de apriete: **16 ± 1,6 Nm**

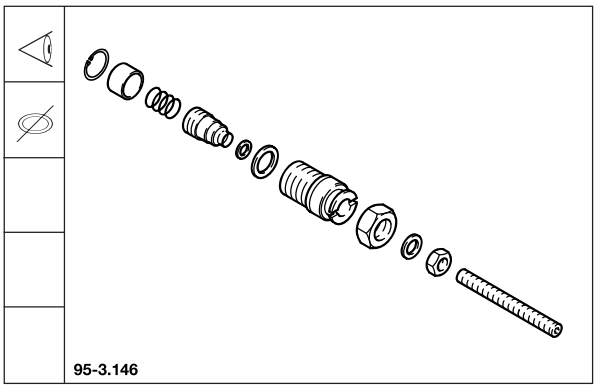
26. Introducir girando la pieza 4 en la pieza 5 hasta el tope. Luego, girarla **1 vuelta entera** en sentido contrario.
Apretar la pieza 6.

Prescripción de apriete: **6 ± 0,6 Nm**

27. Enroscar el mecanismo corrector de par.

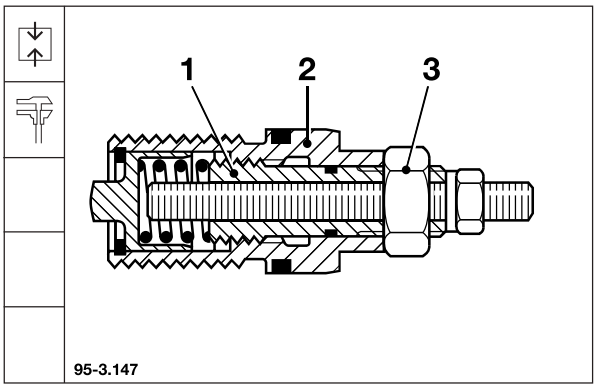
Deutsch

24. Falls vorhanden, Einzelteile der Angleichung sichtprüfen. Ggf. austauschen.



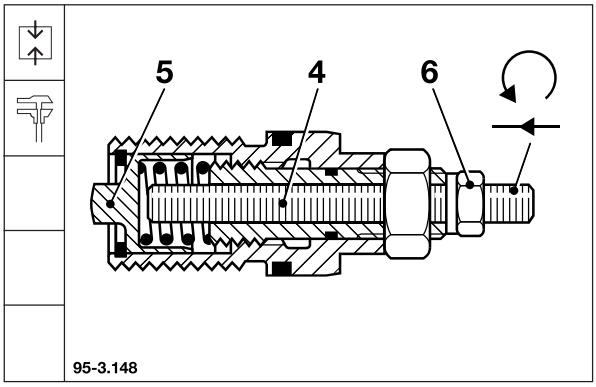
25. Angleichung vormontieren.
    Pos. 1 bis Anschlag in Pos. 2 hineindrehen, Anschließend **1 + 0,5 Umdrehungen** herausdrehen.
    Pos. 3 festdrehen.

    Anziehvorschrift: **16 ± 1,6 Nm**

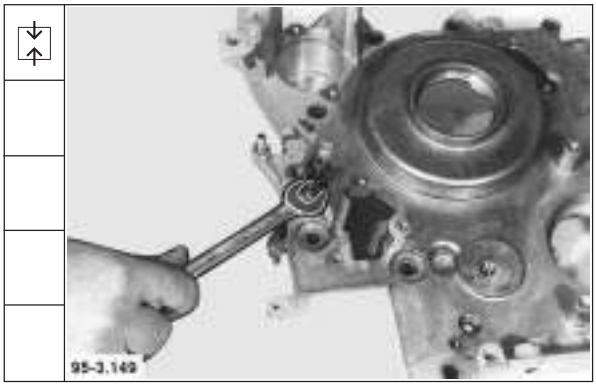


26. Pos. 4 bis zur Anlage an Pos 5 hineindrehen.
    Anschließend **1 Umdrehung** herausdrehen.
    Pos. 6 festdrehen.

    Anziehvorschrift: **6 ± 0,6 Nm**



27. Angleichung hineindrehen.



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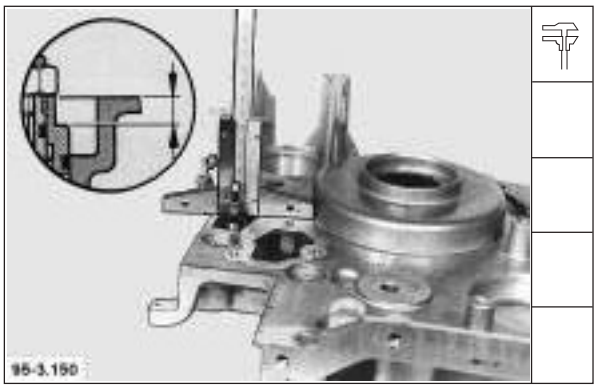
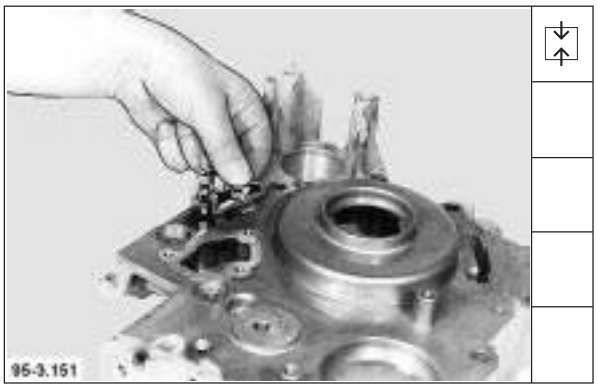
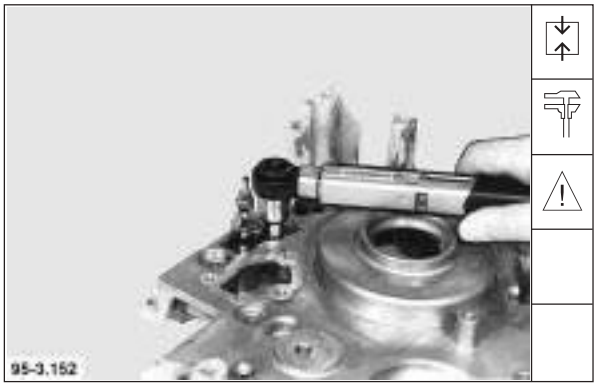
Deutsch



28. Einschraubtiefe messen: **6,4 ± 0,5 mm**



29. Spannpratze auflegen.



30. Spannmutter festdrehen.

    Anziehvorschrift: **10 ± 1 Nm**

Hinweis: Zur exakten Angleicheinstellung ist ein Prüfstandslauf erforderlich.

31. Wellendichtring für Nockenwelle ungeölt einpressen.

English

28. Gauge thread reach: **6.4 ± 0.5 mm**

29. Position clamping pad.

30. Tighten clamping nut.

    Tightening specification: **10 ± 1 Nm**

Note: Bench test required for precise adjustment of torque control.

31. Press in camshaft seal without using oil.

Français

28 Faire un relevé de la profondeur de vissage: **6,4 ± 0,5 mm.**

29. Placer une patte de serrage.

30. Serrer l'écrou de serrage

    Consigne de serrage: **10 ± 1 Nm.**

Nota: pour effectuer une correction de débit très précise il faut procéder à une marche au banc d'essais.

31. Monter à la presse joint d'arbre à cames sans l'huiler.

Español

28. Medir la profundidad de enroscado: **6,4 ± 0,5 mm.**

29. Colocar la garra de sujeción.

30. Apretar la tuerca de fijación.

    Prescripción de apriete: **10 ± 1 Nm**

Nota: Para el ajuste exacto de la asimilación se necesita una marcha en el banco de pruebas.

English

32. Press in crankshaft seal without using oil.

33. Adjust distance of shutdown stop screw and tighten:

    Tightening specification: **4.5 Nm**

34. Adjust distance of min. speed setscrew and tighten.

    Tightening specification: **4.5 Nm**

Note: The above adjustment data rep resent basic values. It is necessary to carry out a bench test for setting engine power and speed.

35. Slide spacer bush and spring onto shutdown shaft.

Français

32. Monter à la presse le joint de vilebrequin sans l'huiler.

33. Régler l'écartement de la vis de butée de stop et serrer.

    Consigne de serrage: **4,5 Nm**

34. Régler l'écartement de la vis d'accélération min puis serrer.

    Consigne de serrage: **4,5 Nm**

Nota: les précisions de réglage précitées sont des valeurs de base. Pour le réglage de la puissance et de la vitesse de rotation, il est nécessaire de procéder à une marche au banc d'essais.

35. Glisser la douille d'écartement sur l'arbre d'arrêt.

Español

32. Introducir a presión y sin aceitar el retén para el cigüeñal.

33. Ajustar la distancia del tornillo del tope de parada y apretarlo.

    Prescripción de apriete: **4,5 Nm**

34. Ajustar la distancia del tornillo de velocidad mínima y apretarlo.

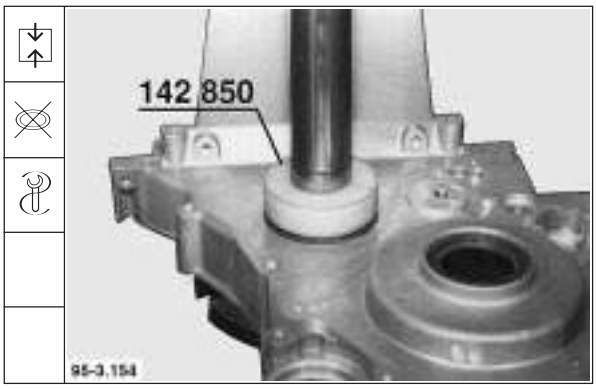
    Prescripción de apriete: **4,5 Nm**

Nota: En los datos de ajuste precitados se trata de valores básicos. Para el ajuste de la potencia y de la velocidad se requiere una marcha en el banco de pruebas.

35. Colocar sobre el eje de parada el casquillo distanciador y el resorte.

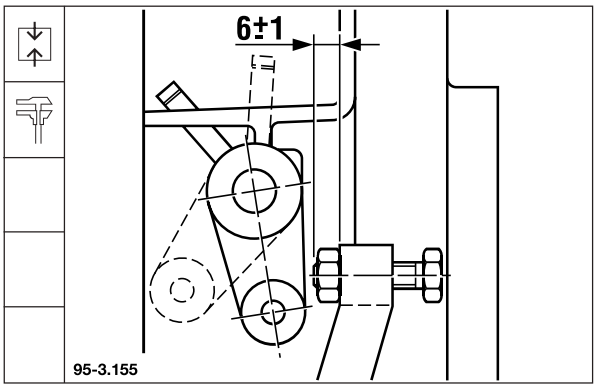
Deutsch

32. Wellendichtring für Kurbelwelle ungeölt einpressen.



33. Abstand der Stop-Anschlagschraube einstellen und festdrehen.

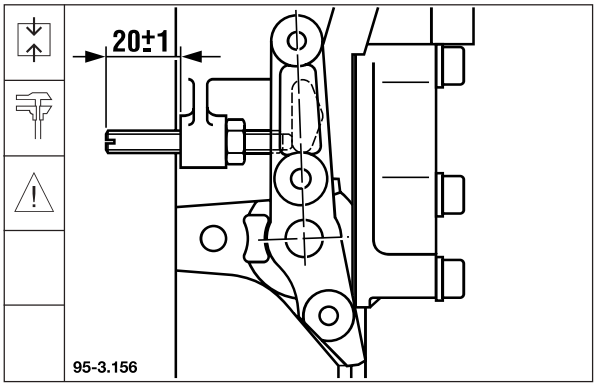
    Anziehvorschrift: **4,5 Nm**



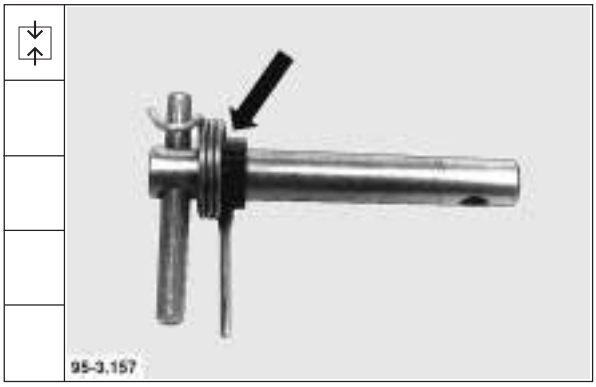
34. Abstand der min. Drehzahlschraube einstellen und festdrehen.

    Anziehvorschrift: **4,5 Nm**

Hinweis: Die vorgenannten Einstellangaben sind Grundwerte. Zur Leistungs- und Drehzahleinstellung ist ein Prüfstandslauf erforderlich.



35. Abstandsbuchse und Feder auf Abstellwelle schieben.



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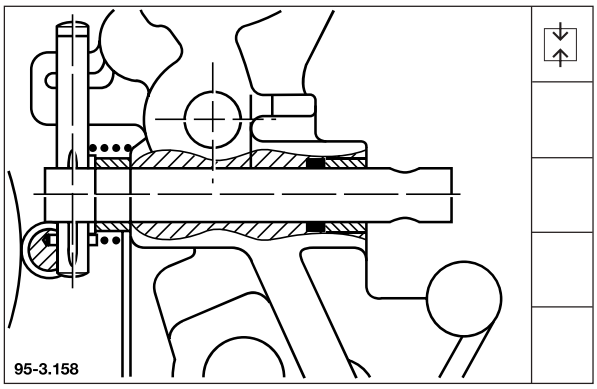


36. Abstellwelle einbauen.

37. Eingefetteten Runddichtring auf die Welle schieben.

38. Abstandsbuchse aufschieben.

39. Abstellhebel mit Spannhülse montieren.

English

36. Install shutdown shaft.

37. Slide greased O-seal onto shaft.

38. Slide on spacer bush.

39. Assemble shutdown lever with dowel sleeve.

Français

36. Monter l'arbre d'arrêt.

37. Introduire le joint d'arbre enduit de graisse sur l'arbre.

38. Insérer la douille d'écartement.

39. Monter le levier d'arrêt avec la douille de serrage.

Español

36. Montar el eje de parada.

37. Colocar el anillo tórico engrasado sobre el eje.

38. Colocar el casquillo distanciador.

39. Montar la palanca de parada y el casquillo de sujeción.

English

40. Fit greased O-seal.

41. Fit spacer bush to speed control shaft and press in.

Note: Watch direction of installation of speed control lever.

42. Assemble speed control lever with dowel sleeve.

Français

40. Monter un joint torique enduit de graisse.

41. Monter et enfoncer la douille d'écartement sur l'arbre de réglage de vitesse.

Nota: tenir compte du sens de montage du levier de réglage de vitesse.

42. Monter le levier de réglage de vitesse avec la douille de serrage.

Español

40. Montar el anillo tórico engrasado.

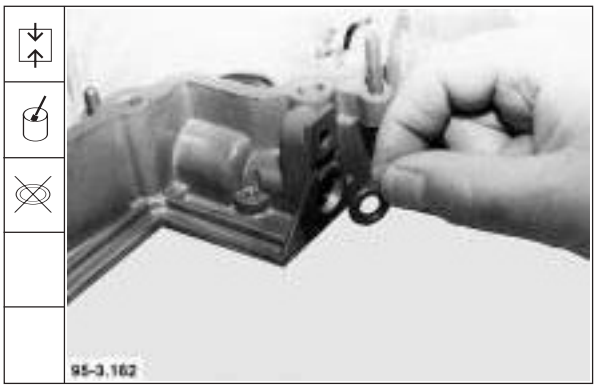
41. Montar el casquillo distanciador sobre el eje de velocidad e introducirlo a presión.

Nota: Prestar atención a la dirección de montaje de la palanca de ajuste de velocidad.

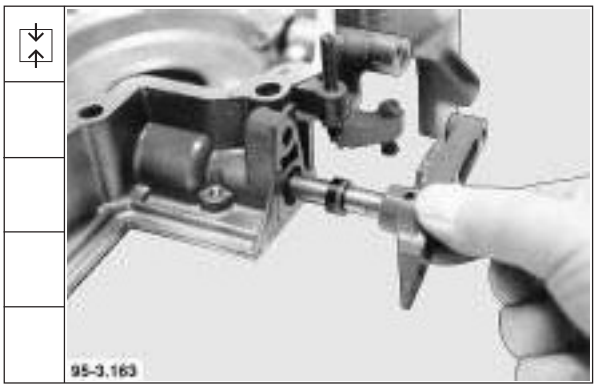
42. Montar la palanca de ajuste de velocidad con casquillo de sujeción.

Deutsch

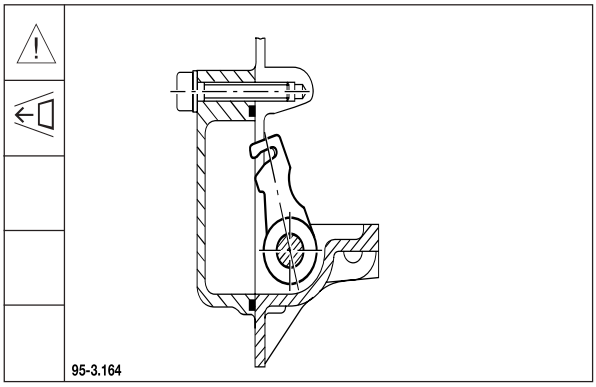
40. Eingefetteten Runddichtring montieren.



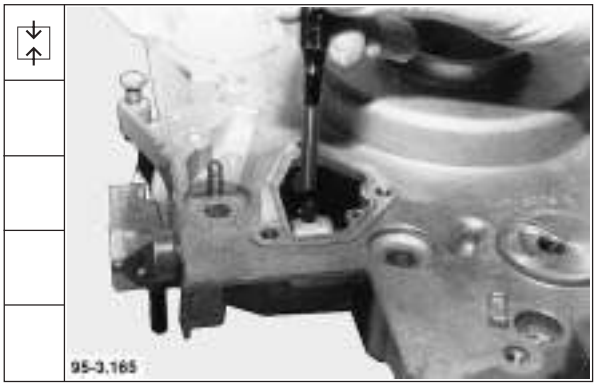
41. Abstandsbuchse auf Drehzahlwelle montieren und eindrücken.



Hinweis: Einbaurichtung des Drehzahlverstellhebels beachten.



42. Drehzahlverstellhebel mit Spannhülse montieren.



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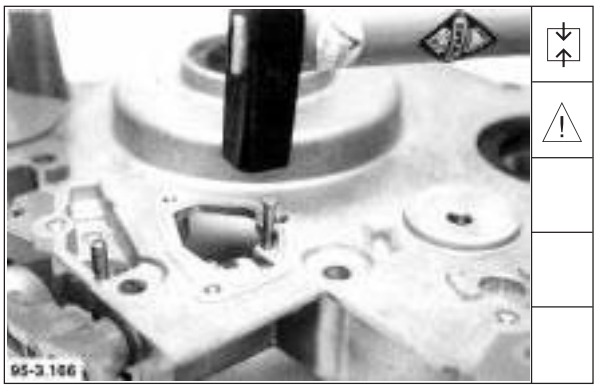


43. Bolzen eintreiben.

Hinweis: Nut der Drehzahlverstellwelle muß mit Bohrung für Bolzen auf Überdeckung stehen.

44. Fliehkraftregler auf Verschleiß sichtprüfen, ggf. austauschen.

45. Reglerteller sichtprüfen, ggf. austauschen.

46. Reglerteller mit Fliehkraftregler montieren.

Hinweis: Einbaurichtung beachten.

English

43. Drive in pin.

Note: Groove of speed control shaft must be in line with pin bore.

44. Inspect centrifugal governor for wear and replace if necessary.

45. Inspect governor plate and replace if necessary.

46. Assemble governor plate with centrifugal governor.

Note: Watch direction of installation.

Français

43. Introduire boulon.

Nota: la rainure de l'arbre de réglage de vitesse doit correspondre à l'alésage du boulon.

44. Contrôler visuellement l'usure du régulateur centrifuge, au besoin le remplacer.

45. Contrôler visuellement le disque du régulateur, au besoin le remplacer.

46. Monter le disque du régulateur avec le régulateur centrifuge.

Nota: tenir compte du sens de montage.

Español

43. Introducir a golpes el perno.

Nota: La ranura del eje de ajuste de velocidad tiene que coincidir con el taladro para el perno.

44. Examinar visualmente el regulador centrífugo en cuanto a desgaste, sustituyéndolo en caso necesario.

45. Examinar visualmente el plato de regulador, sustituyéndolo en caso necesario.

46. Unir el plato con el regulador centrífugo.

Nota: Prestar atención a la dirección de montaje.

English

47. Install centrifugal governor in front cover.

Note: Be careful not to damage sealing lip of shaft seal.

48. Inspect roller lever, shaft and idling lever and replace if necessary.

49. Insert shims of at least **0.3 mm** thickness at points „K“ and „L“.

50. Install governor lever shaft without idling lever. Tighten bolts.

    Tightening specification: **9.2 Nm**

Français

47. Poser le régulateur centrifuge dans le couvercle avant.

Nota: ne pas détériorer la lèvre d’étanchéité du joint d’arbre.

48. Contrôle visuel du levier à galets, de l’arbre et du levier de ralenti, les remplacer au besoin.

49. Au cas où il y aurait des cales de compensation, intercaler aux points „K“ et „L“ une épaisseur d’au moins **0,3 mm.**

50. Monter l’arbre du levier du régulateur sans levier de ralenti. Serrer les vis.

    Consigne de serrage **9,2 Nm.**

Español

47. Colocar el regulador centrífugo en la tapa delantera.

Nota: No dañar el labio de obturación del retén.

48. Examinar visualmente la palanca de rodillos, el eje y la palanca de marcha en vacío, sustituyéndolos en caso necesario.

49. Colocar en los puntos „K“ y „L“ arandelas de ajuste de por lo menos **0,3 mm.**

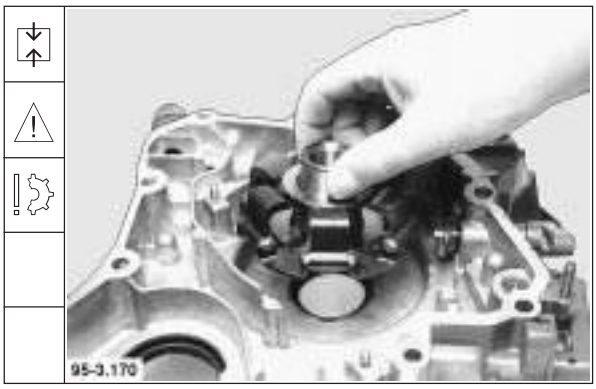
50. Montar el eje de palanca de regulador sin la palanca de marcha en vacío. Apretar los tornillos.

    Prescripción de apriete: **9,2 Nm**

Deutsch

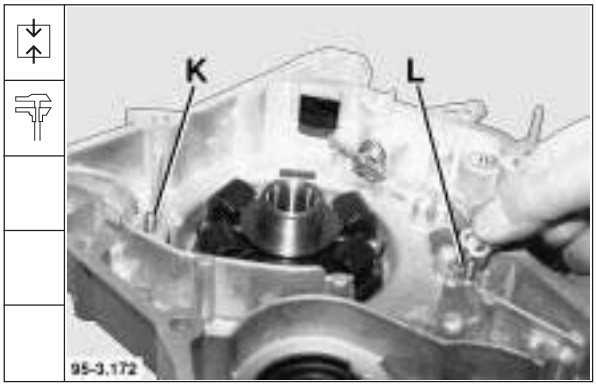
47. Fliehkraftregler in vorderen Deckel einsetzen.

Hinweis: Dichtlippe des Wellendichtringes nicht beschädigen.



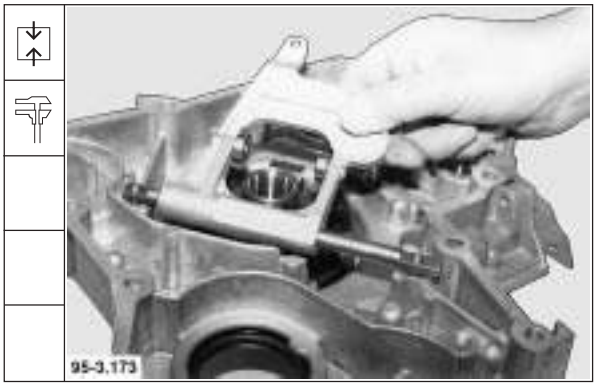
48. Rollenhebel, Welle und Leerlaufhebel sichtprüfen, ggf. austauschen.

49. Ausgleichscheiben an den Stellen „K“ und „L“ mindestens **0,3 mm** unterlegen.



50 Reglerhebelwelle ohne Leerlaufhebel einbauen. Schrauben festdrehen.

Anziehvorschrift: **9,2 Nm**



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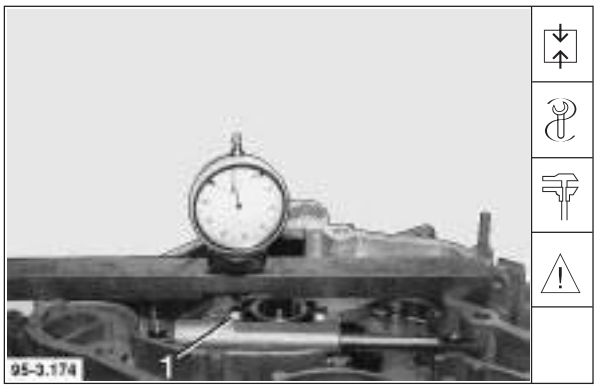
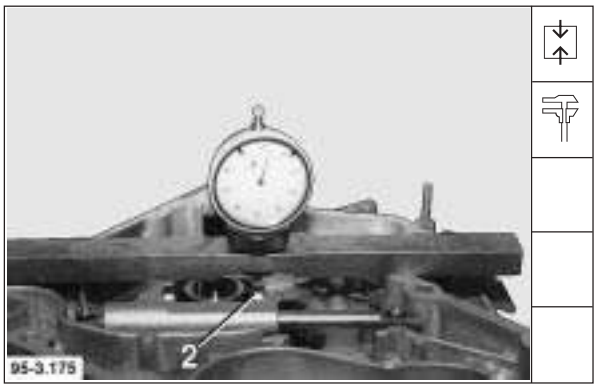
Deutsch



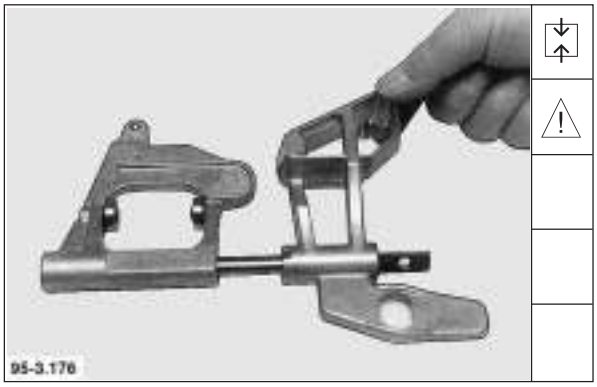
Parallelität des Rollenhebels messen:

51. Gemessen wird unter leichtem Andruck des Rollenhebels auf dem Kugellager Pos. 1

Hinweis: Meßuhr auf Null stellen.

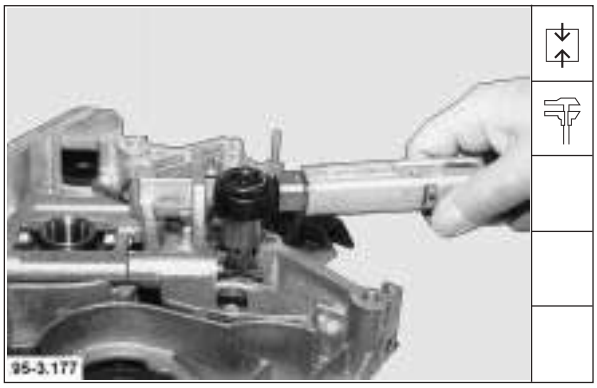


52. Meßuhr auf Pos. 2 setzen. Abweichung notieren.
    Zum Erreichen der geforderten Toleranz von **0,05 mm** kann an einer Stelle „K oder L“ zusätzlich max. **0,5 mm** unterlegt werden.



53. Rollenhebel mit Leerlaufhebel und Welle montieren.

Hinweis: Einbaurichtung beachten.



54. Reglerhebelwelle kompl. in vorderen Deckel einbauen. Schrauben festdrehen.

    Anziehvorschrift: **9,2 Nm**

English

Measuring parallelism of roller lever:

51. Measure on ball bearing, item 1, by lightly pressing roller lever.

Note: Set dial gauge to zero.

52. Place dial gauge on item 2. Note deviation.
To attain the required tolerance of **0.05 mm**, it is possible to insert an additional shim of max. **0.5 mm** either at point „K“ or „L“.

53. Assemble roller lever with idling lever and shaft.

Note: Watch direction of installation.

54. Install complete governor lever shaft in front cover. Tighten bolts.

Tightening specification: **9.2 Nm**

Français

Relevé du parallélisme du levier à galet:

51. La mesure se fait en appuyant légèrement sur le levier à galets au niveau du roulement à billes (1).

Nota: régler le comparateur sur zéro.

52. Placer le comparateur sur rep. 2. Relever l’écart.
Pour obtenir la tolérance voulue de **0,05 mm** il est possible d’intercaler en plus au point „K ou L“ une épaisseur maxi de **0,5 mm.**

53. Monter le levier à galets avec le levier de ralenti et l’arbre.

Nota: tenir compte du sens de montage.

54. Monter arbre de levier du régulateur complet dans couvercle avant. Serrer les vis.

Consigne de serrage: **9,2 Nm**

Español

Medición del paralelismo de la palance de rodillos:

51. La medición se realiza presionando la palanca de rodillos ligeramente a nivel del cojinete de bolas 1.

Nota: Ajustar el comparador a cero.

52. Colocar el comparador sobre 2. Anotar la desviación.
Para alcanzar la tolerancia exigida de **0,05 mm,** se puede colocar adicionalmente una arandela de hasta **0,5 mm** en uno de los puntos „K“ o „L„.

53. Unir la palanca de rodillos con la palanca de marcha en vacío y con el eje.

Nota: Observar la dirección de montaje.

54. Montar el eje de palanca de regulador completo en la tapa delantera. Apretar los tornillos.

Prescripción de apriete: **9,2 Nm**

English

55. Hook up governor spring.

56. Mount cover with new gasket. Tighten bolts.

    Tightening specification: **4.5 Nm**

57. If engine shutdown device is provided, position O-seal and grease.

58. Install engine shutdown device and tighten bolts.

    Tightening specification: **9 Nm**

Note: Watch direction of installation.

Français

55. Accrocher le ressort du régulateur.

56. Monter le couvercle en renouvellant le joint.

    Consigne de serrage **4,5 Nm**

57. Au cas où le moteur est équipé d'un dispositif d'arrêt placer un joint torique enduit de graisse.

58. Monter dispositif d'arrêt moteur et serrer vis.

    Consigne de serrage: **9 Nm**

Nota: respecter le sens de montage.

Español

55. Enganchar el resorte regulador.

56. Montar la tapa con una junta nueva. Apretar los tornillos.

    Prescripción de apriete: **4,5 Nm**

57. Si existe un dispositivo de parada del motor: colocar y engrasar el anillo tórico.

58. Montar el dispositivo de parada y apretar los tornillos.

    Prescripción de apriete: **9 Nm**

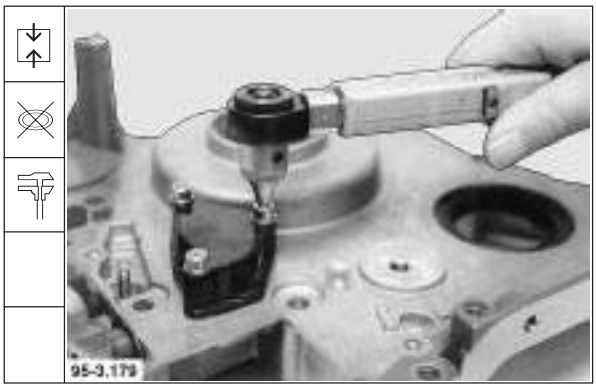
Nota: Observar la dirección de montaje.

Deutsch

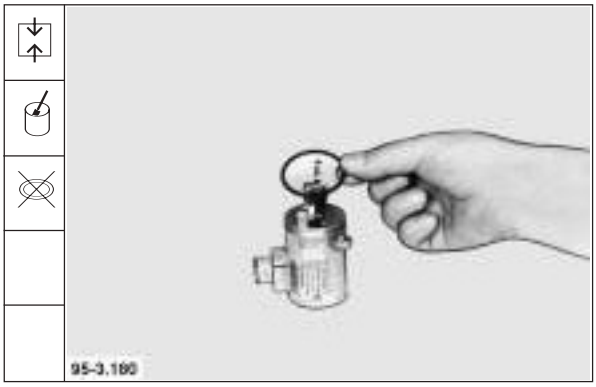
55. Reglerfeder einhängen.

56. Deckel mit neuer Dichtung montieren. Schrauben festdrehen.

    Anziehvorschrift: **4,5 Nm**



57. Falls Motorabstellung vorhanden. Runddichtring auflegen und einfetten.



58. Motorabstellung einbauen und Schrauben festdrehen.

    Anziehvorschrift: **9 Nm**

Hinweis: Einbaurichtung beachten.

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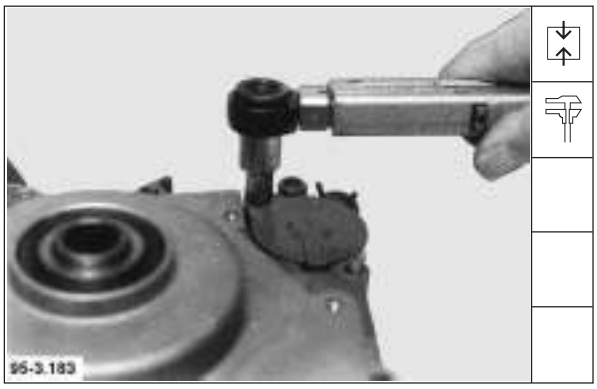
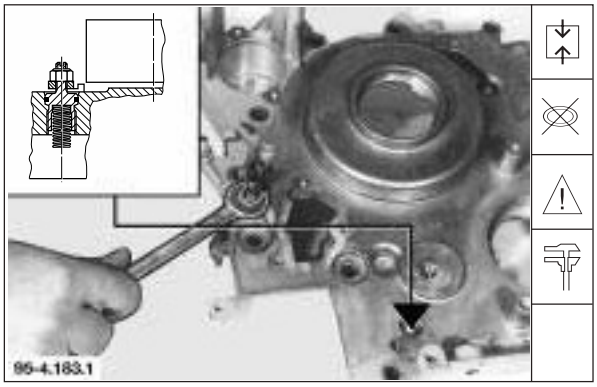
Deutsch

60. Neuen Runddichtring auflegen.



61. Kurbelgehäuseentlüftung montieren. Schraube festdrehen.

    Anziehvorschrift: **8,5 Nm**



62. Falls vorhanden, Leerlaufkapsel mit neuem Runddichtring bis Innenkante vorderer Deckel bündig einschrauben. Sechskantschraube festdrehen.

    Anziehvorschrift: **4,6 ± 0,4 Nm**

English

60. Position new O-seal.

61. Fit crankcase breather. Tighten bolts.

    Tightening specification: **8.5 Nm**

62. Screw in idle-speed casting, if any, with new O-seal flush with inner edge of front cover. Tighten hex. bolt.

    Tightening specification: **4.6 ± 0,4 Nm**

Français

60. Placer un joint torique neuf.

61. Monter évent de carter. Serrer les vis.

    Consigne de serrage: **8,5 Nm**

62. Si le moteur en est équipé d'une, visser à fleur, jusqu'au bord intérieur du couvercle avant, la capsule de ralenti avec un joint torique neuf.
    Bloquer la vis hexagonale.

    Consigne de serrage: **4,6 ± 0,4 Nm**

Español

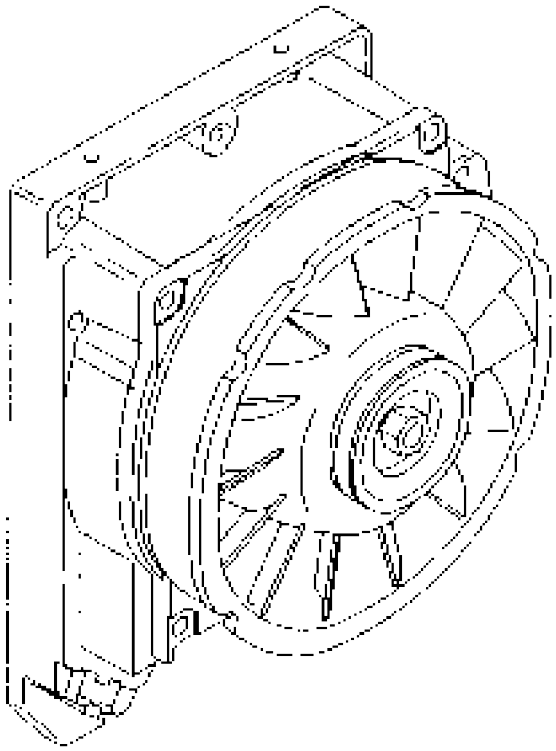
60. Colocar un anillo tórico nuevo.

61. Montar el elemento de ventilación del cárter. Apretar el tornillo.

    Prescripción de apriete: **8,5 Nm**

62. Si existe, enroscar a ras, hasta el canto interior de la tapa delantera, cápsula de marcha en vacío provista de un anillo tórico nuevo. Apretar el tornillo hexagonal.

    Prescripción de apriete: **4,6 ± 0,4 Nm**



English

1. Remove blower jacket inlet.
2. Remove air duct.
3. Unscrew fastening nut. Remove washer.
4. Remove V-belt pulley and rotor.

Français

1. Déposer entrée de l'enveloppe de la turbine.
2. Déposer gaine d'air.
3. Dévisser écrou de fixation et extraire la rondelle.
4. Retirer la poulie à gorge et la roue à aube.

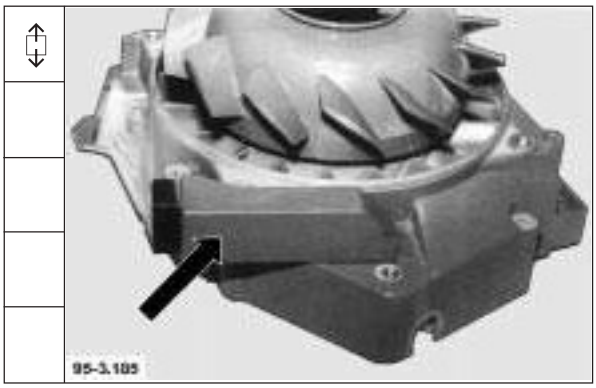
Español

1. Desmontar la entrada envolvente del ventilador.
2. Desmontar el canal de aire.
3. Desenroscar la tuerca de fijación. Quitar la arandela.
4. Quitar la polea de correa trapezoidal y el rotor.

Deutsch

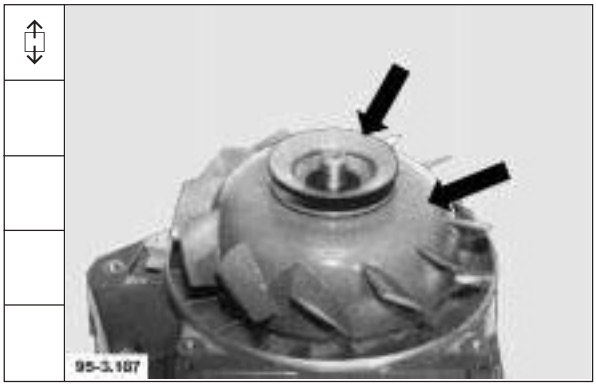
1. Gebläsemantel-Einlauf abbauen.

2. Luftkanal abbauen.



3. Befestigungsmutter abschrauben. Scheibe abnehmen.

4. Keilriemenscheibe und Laufrad abnehmen.



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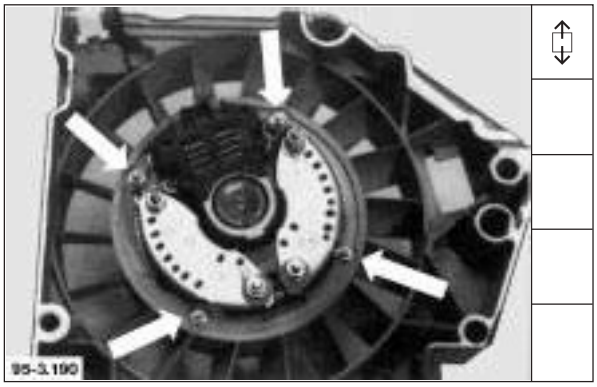
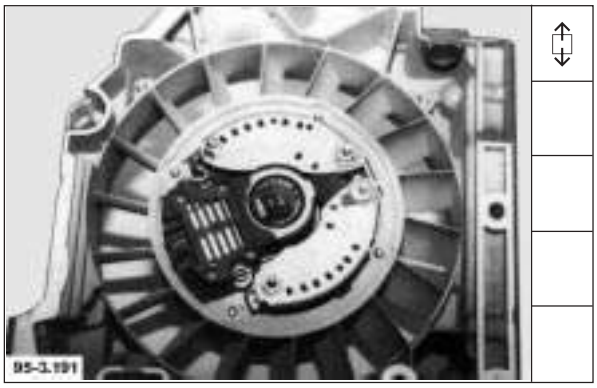
Deutsch

5. Distanzscheibe abnehmen.

6. Führungsscheibe abnehmen.



7. Befestigungsmutter abschrauben.



8. Generator herausdrücken.

English

5. Remove spacer.

6. Remove guide disc.

7. Unscrew fastening nut.

8. Press out alternator.

Français

5. Retirer le disque d'écartement.

6. Retirer le disque de guidage.

7. Dévisser l'écrou de fixation.

8. Extraire l'alternateur.

Español

5. Quitar la arandela distanciadora.

6. Quitar el disco de guía.

7. Desenroscar la tuerca de fijación.

8. Desmontar a presión el alternador.

English

9. Inspect all single parts and replace if necessary.

10. Introduce alternator into blower.

Note: Watch direction of installation.

11. Position washers, tighten nuts.

Tightening specification: **4 Nm**

Français

9. Contrôler visuellement toutes les pièces, au besoin les changer.

10. Placer l'alternateur dans la turbine de refroidissement.

Nota: respecter le sens de montage.

11. Placer des rondelles de compensation puis bloquer les écrous.

Consigne de serrage: **4 Nm**

Español

9. Examinar visualmente todas las piezas, sustituyéndolas en caso necesario.

10. Colocar el alternador en el ventilador.

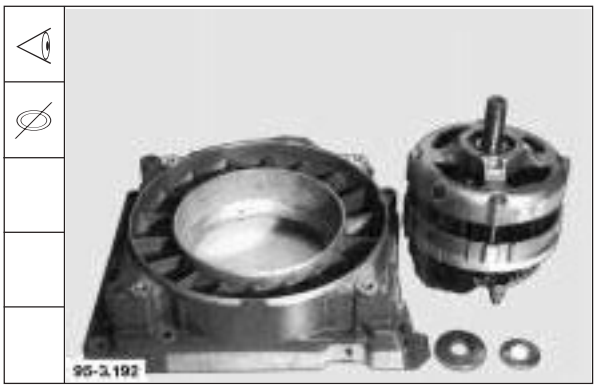
Nota: Observar la dirección de montaje.

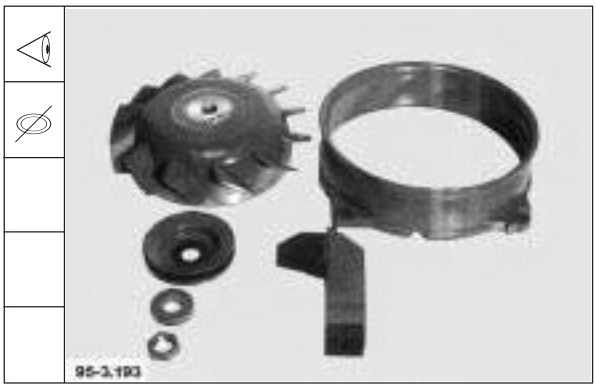
11. Colocar las arandelas de calce y apretar las tuercas.

Prescripción de apriete: **4 Nm**

Deutsch

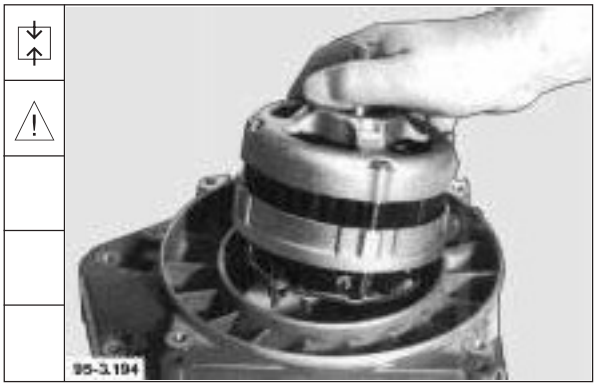
9. Alle Teile sichtprüfen, ggf. auswechseln.





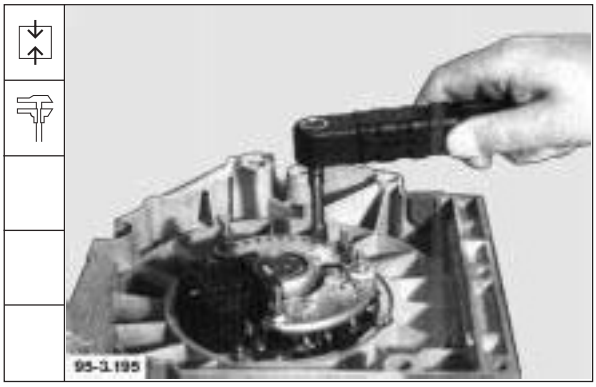
10. Generator in Kühlgebläse einsetzen.

Hinweis: Einbaurichtung beachten.



11. Unterlegscheiben auflegen, Muttern festdrehen.

    Anziehvorschrift: **4 Nm**



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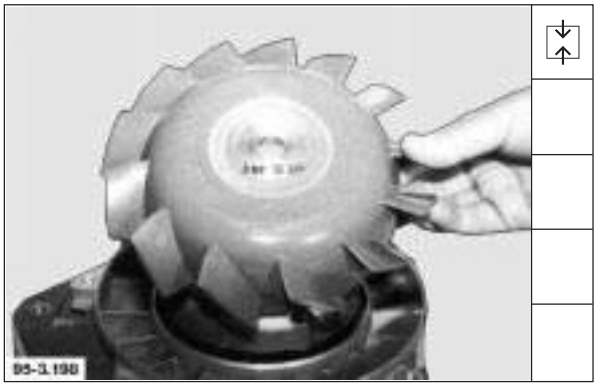
Deutsch

12. Führungsscheibe auflegen.

Hinweis: Abgesetzte Seite muß zum Generator weisen.

13. Distanzscheibe auflegen.



14. Laufrad einbauen.

15. Keilriemenscheibe auflegen.

English

12. Position guide disc.

Note: Shouldered side must face alternator.

13. Position spacer.

14. Install rotor.

15. Position V-belt pulley.

Français

12. Placer une rondelle de guidage.

Nota: côté à épaulement doit être orienté vers l'alternateur.

13. Placer une rondelle intercalaire.

14. Monter la roue à aube.

15. Placer la poulie à gorge.

Español

12. Colocar el disco de guía.

Nota: La cara escalonada debe indicar hacia el alternador.

13. Colocar la arandela distanciadora.

14. Montar el rotor.

15. Colocar la polea de correa trapezoidal.

English

16. Position washer.

17. Screw on fastening nut and tighten.

    Tightening specification: **50 Nm**

18. Position blower jacket inlet.

19. Tighten fastening bolts.

    Tightening specification: **22 Nm**

Français

16. Placer une rondelle.

17. Poser écrou de fixation et serrer.

    Consigne de serrage: **50 Nm**

18. Mettre en place entrée de l'enveloppe de la turbine.

19. Serrer vis de fixation.

    Consigne de serrage: **22 Nm**

Español

16. Colocar la arandela.

17. Enroscar la tuerca de fijación y apretarla.

    Prescripción de apriete: **50 Nm**

18. Colocar la entrada envolvente del ventilador.

19. Apretar los tornillos de fijación.

    Prescripción de apriete: **22 Nm**

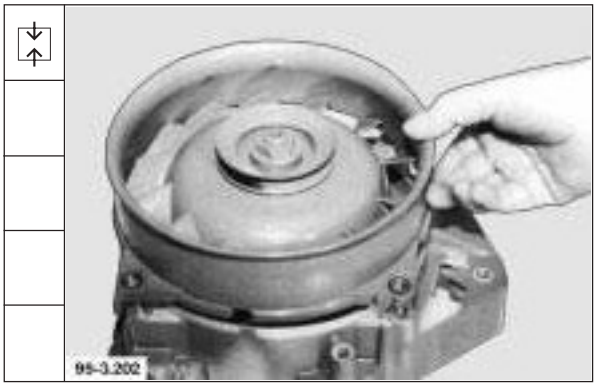
Deutsch

16. Scheibe auflegen.

17. Befestigungsmutter aufschrauben und fest-drehen.

    Anziehvorschrift: **50 Nm**

18. Gebläsemantel-Einlauf aufsetzen.



19. Befestigungsschrauben festdrehen.

    Anziehvorschrift: **22 Nm**

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Deutsch

20. Spaltmaß zwischen Laufrad und Gebläsemantel-Einlauf messen.

    min. = 0,2 mm
    max. = 0,8 mm

21. Zur Korrektur entsprechende Distanzscheibe verwenden.

Hinweis: Es stehen Distanzscheiben von 5,0 - 7,5 mm zur Verfügung.

22. Luftkanal anbauen.
    Schraube festdrehen.

3

English

20. Gauge clearance between rotor and blower jacket inlet.

    min. = 0.2 mm
    max. = 0.8 mm

21. Use relevant spacer for correction.

Note: Spacers with 5.0 - 7.5 mm thickness are available.

22. Mount air duct. Tighten bolt.

Français

20. Mesurer le jeu d'entrefer entre la roue à aube et l'entrée de l'enveloppe de la turbine.

    Minimum 0,2 mm
    Maximum 0,8 mm

21. Pour corriger utiliser des rondelles intercalaires appropriées.

Nota: il existe des rondelles intercalaires comprises entre 5,0 et 7,5 mm

22. Remonter la gaine d'air et serrer la vis.

Español

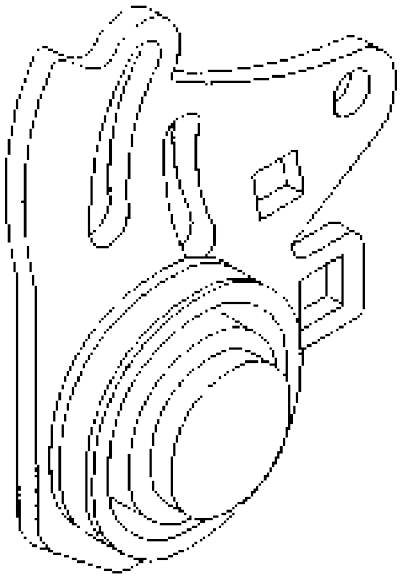
20. Medir la holgura entre el rotor y la entrada envolvente del ventilador.

    mín. = 0,2 mm
    máx. = 0,8 mm

21. Para la corrección usar una arandela distanciadora que corresponda.

Nota: Están disponibles arandelas distanciadoras de 5,0 - 7,5 mm.

22. Montar el canal de aire. Apretar el tornillo.



English

1. Remove clamping plate.

2. Replace damaged idler pulley.

3. Fit clamping plate, Tighten bolt.

   Tightening specification: **21 Nm**

Français

1. Déposer la patte de serrage.

2. Remplacer galet tendeur défectueux.

3. Reposer la patte de serrage et bloquer la vis.

   Consigne de serrage: **21 Nm**

Español

1. Desmontar la corredera.

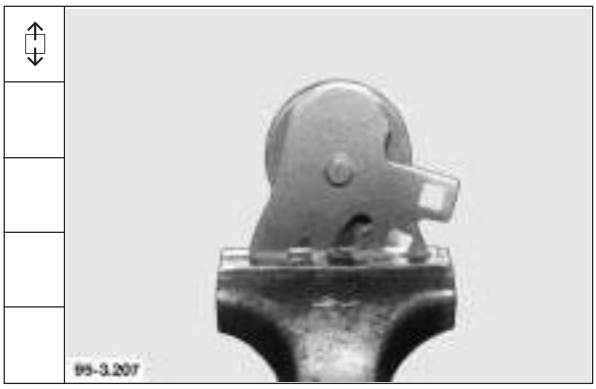
2. Sustituir la polea tensora defectuosa.

3. Montar la corredera. Apretar el tornillo.

   Prescripción de apriete: **21 Nm**

Deutsch

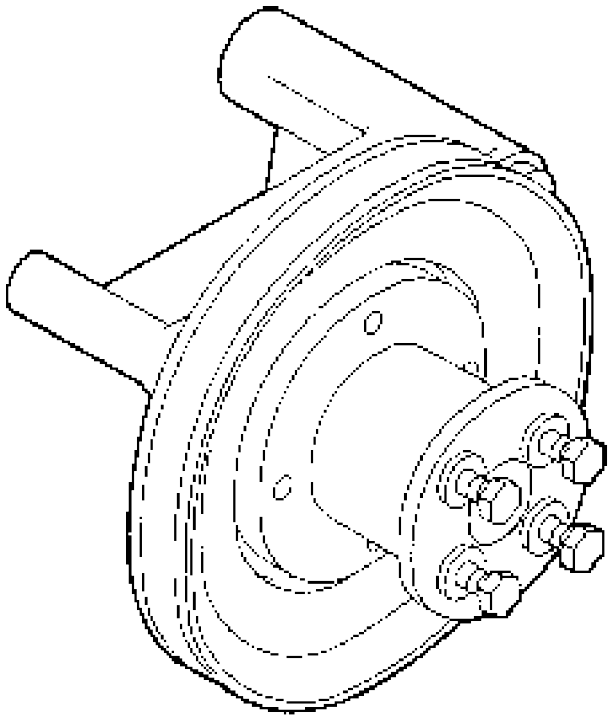
1. Spannlasche abbauen.



2. Schadhafte Spannrolle austauschen.

3. Spannlasche anbauen. Schraube festdrehen.

   Anziehvorschrift: **21 Nm**



English

Commercial tools required:

Torx tool kit _____ 8189
Internal puller

1. Undo cheese-head bolt, pull drive hub from bearing carrier.
2. Take out fastening bolts.
3. Remove V-belt pulley from drive hub.

Français

Entraînement ventilateur

Outillage Torx _____ 8189
Extracteur intérieur

1. Dévisser vis à tête cylindrique, extraire le moyeu d'entraînement du porte-roulement.
2. Retirer vis de fixation.
3. Déposer poulie à gorge du moyeu.

Español

Herramientas comerciales:

Juego de herramientas Torx ___ 8189
Extractor

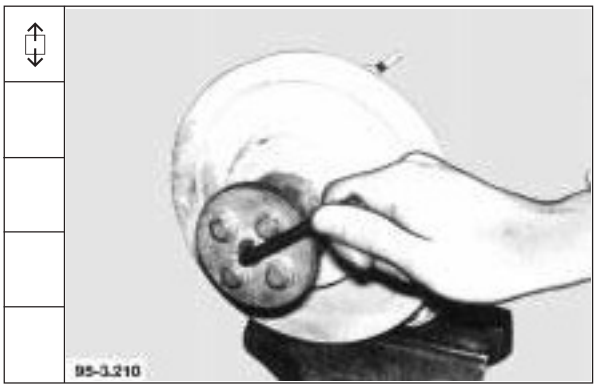
1. Desenroscar el tornillo de cabeza cilíndrica. Separar a presión el cubo de accionamiento del portacojinetes.
2. Retirar los tornillos de fijación.
3. Desmontar la polea de correa trapezoidal del cubo de accionamiento.

Deutsch

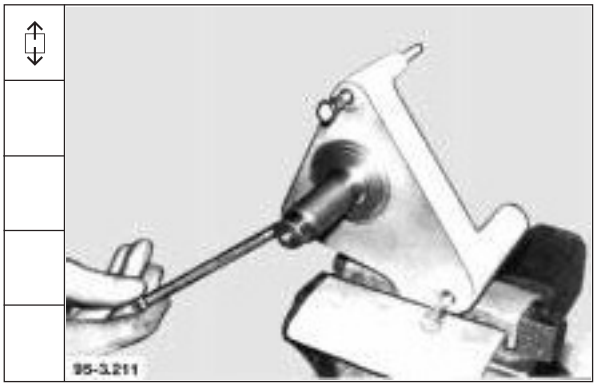
Handelübliche Werkzeuge:

Torx-Werkzeugsatz _____ 8189
Innenauszieher

1. Zylinderschraube herausdrehen, Antriebsnabe von dem Lagerträger abdrücken.



2. Befestigungsschrauben herausnehmen.



3. Keilriemenscheibe von Antriebsnabe abbauen.

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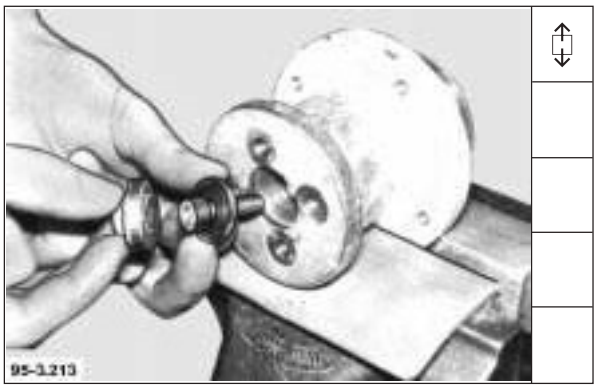
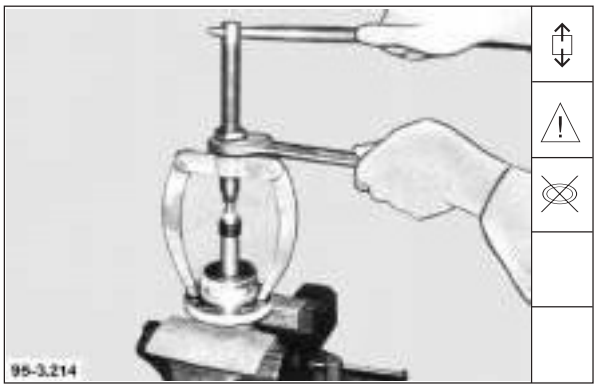
Deutsch

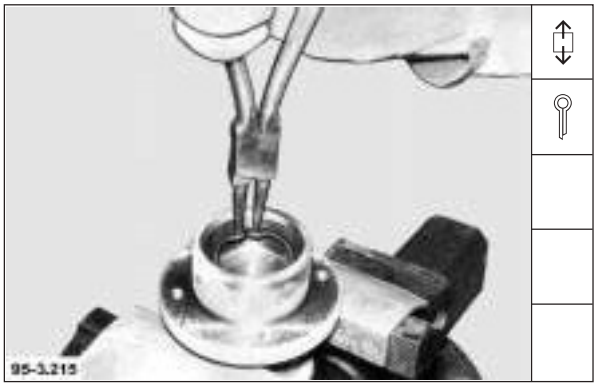


4. Vier Sechskantschrauben herausschrauben, Scheibe und Zylinderschraube mit Scheibe herausdrücken.



5. Äußeres Rillenkugellager herausziehen.

Hinweis: Das Rillenkugellager ist grundsätzlich zu erneuern.



6. Sicherungsring aus der Antriebsnabe herausnehmen.

7. Inneres Rillenkugellager aus der Antriebsnabe herausziehen.

Hinweis: Das Rillenkugellager ist bedingt wiederverwendbar.

English

4. Undo four hexagon bolts, press out disc and cheese-head screw with washer.

5. Pull out outer grooved ball bearing.

Note: The grooved ball must always be renewed.

6. Take out circlip from drive hub.

7. Pull out inner grooved ball bearing from drive hub.

Note: The grooved ball bearing is possibly still fit for further use.

Français

4. Dévisser les quatre vis hexagonales puis extraire rondelle et vis à tête cylindrique avec rondelle.

5. Retirer le roulement rainuré à billes extérieur.

Nota: changer systématiquement le roulement rainuré à billes.

6. Extraire le circlip du moyeu.

7. Extraire le roulement rainuré à billes du moyeu.

Nota: le roulement à billes n'est qu'en partie réutilisable.

Español

4. Desenroscar los cuatro tornillos hexagonales. Desmontar a presión el disco y el tornillo de cabeza cilíndrica con arandela.

5. Extraer el cojinete de bolas fijo exterior.

Nota: El cojinete deberá ser sustituido siempre por otro nuevo.

6. Sacar el anillo de retención del cubo de accionamiento.

7. Extraer el cojinete de bolas fijo interior del cubo de accionamiento.

Nota: El cojinete es reutilizable condicionalmente.

English

8. Press in inner grooved ball bearing via outer race as far as it will go.

9. Insert circlip in drive hub.

10. Press in outer grooved ball bearing via outer race as far as it will go.

11. Fit V-belt pulley. Tighten bolts.

    Tightening specification: **21 Nm**

Note: Watch direction of installation.

Français

8. Enfoncer roulement rainuré à billes intérieur par la bague extérieure jusqu'en position de butée.

9. Insérer circlip sur le moyeu.

10. Enfoncer roulement rainuré à billes extérieur par la bague extérieure jusqu'en position de butée.

11. Monter poulie à gorge. Serrer les vis.

    Consigne de serrage: **21 Nm**

Nota: respecter le sens de montage.

Español

8. Introducir a presión el cojinete de bolas fijo interior, a través del anillo exterior, hasta el tope.

9. Colocar el anillo de retención en el cubo de accionamiento.

10. Introducir a presión el cojinete de bolas fijo exterior, a través del anillo exterior, hasta el tope.

11. Montar la polea de correa trapezoidal. Apretar los tornillos.

    Prescripción de apriete: **21 Nm**

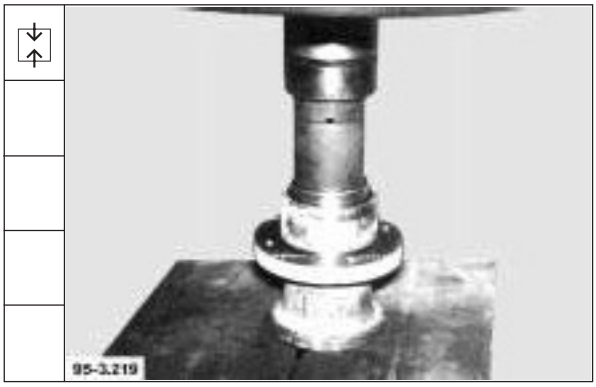
Nota: Observar la dirección de montaje.

Deutsch

8. Inneres Rillenkugellager über den Außenring bis zur Anlage eindrücken.

9. Sicherungsring in die Antriebsnabe einsetzen.

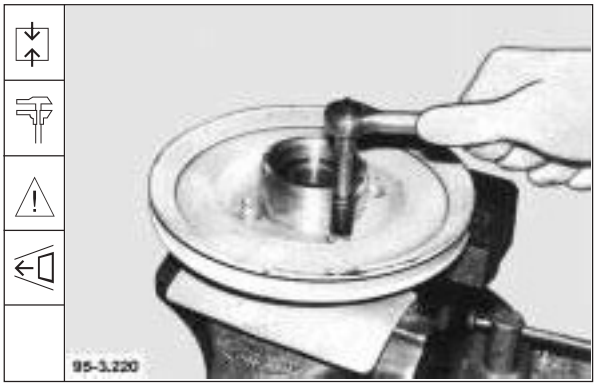
10. Äußeres Rillenkugellager über den Außenring bis zur Anlage eindrücken.



11. Keilriemenscheibe anbauen. Schrauben festdrehen.

    Anziehvorschrift: **21 Nm**

Hinweis: Einbaurichtung beachten.



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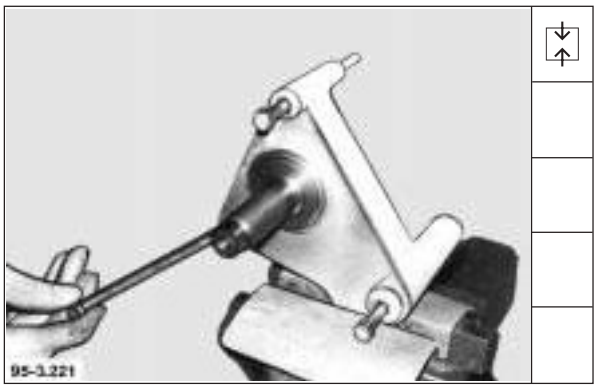
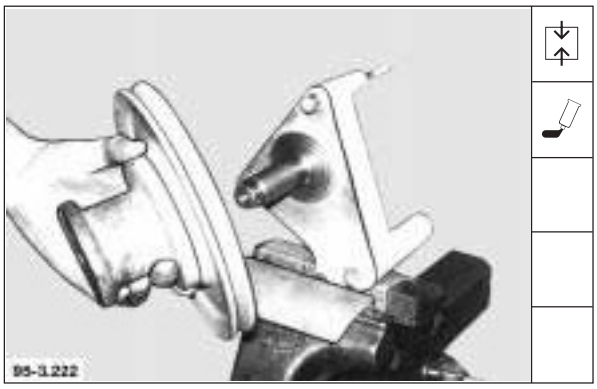
Deutsch



12. Drei Befestigungsschrauben in Lagerträger einstecken.



13. Lagerfläche für äußeres Rillenkugellager mit Sicherungsmittel DEUTZ **DW 55** bestreichen.

14. Zylinderschraube mit Scheibe einsetzen und festdrehen.

    Anziehvorschrift: **21 Nm**

    Antriebsnabe auf den Lagerträger aufsetzen.

15. Scheibe mit Führungsbund nach außen weisend einsetzen.

English

12. Insert three fastening bolts in bearing carrier.

13. Apply locking compound DEUTZ **DW 55** to bearing surface of outer grooved ball bearing.

14. Insert cheese-head screw together with washer and tighten.

    Tightening specification: **21 Nm**

    Place drive hub on bearing carrier.

15. Insert washer with guide collar pointing to the outside.

Français

12. Introduire les trois vis dans le porte-roulement.

13. Enduire surface du roulement rainuré à billes extérieur de pâte d'étanchéité DEUTZ **DW 55.**

14. Placer vis à tête cylindrique avec rondelle et serrer.

    Consigne de serrage: **21 Nm**

    Placer moyeu sur le porte-roulement.

15. Placer rondelle avec collerette de guidage orientée vers l'extérieur.

Español

12. Meter los tres tornillos de fijación en el portacojinetes.

13. Aplicar DEUTZ **DW 55** a la superficie de soporte del cojinete de bolas fijo exterior.

14. Montar el tornillo de cabeza cilíndrica con arandela y apretarlo.

    Prescripción de apriete: **21 Nm**

    Colocar el cubo de accionamiento sobre el portacojinetes.

15. Introducir la arandela con el collarín de guía indicando hacia el exterior.

English

16. Screw in four hexagon bolts, grade 10.9, and tighten.

    With mounted fan:
    Tightening specification: **30 Nm**

Français

16. Introduire les quatre vis hexagonales type 10.9 et serrer.

    Pour montage de ventilateur:
    consigne de serrage: **30 Nm**

Español

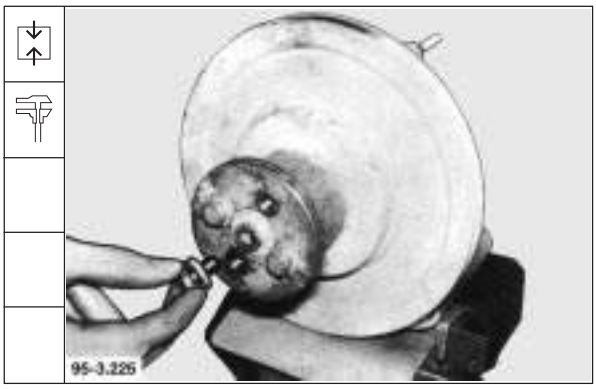
16. Enroscar los cuatro tornillos hexagonales, calidad 10.9, y apretarlos.

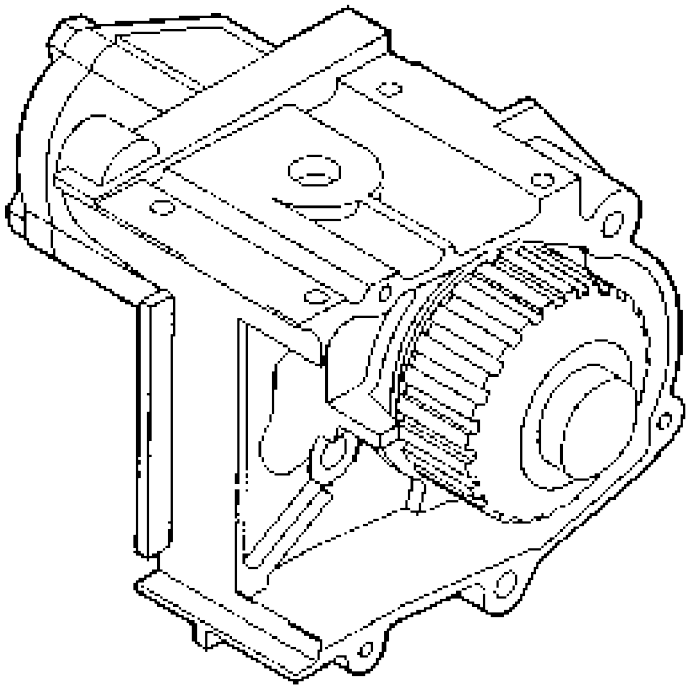
    En caso de montaje del ventilador:
    Prescripción de apriete: **30 Nm**

Deutsch

16. Vier Sechskantschrauben Qualität 10.9 einschrauben und festdrehen.

    Bei Lüfteranbau:
    Anziehvorschrift: **30 Nm**

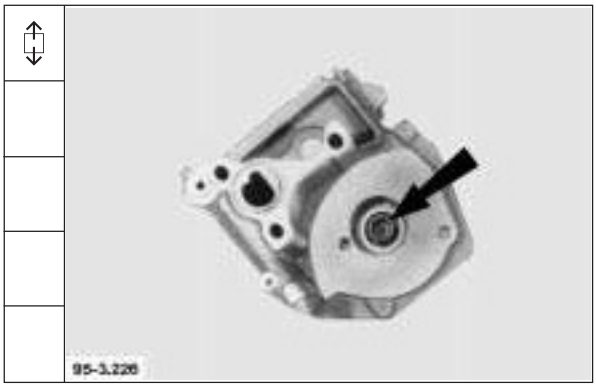




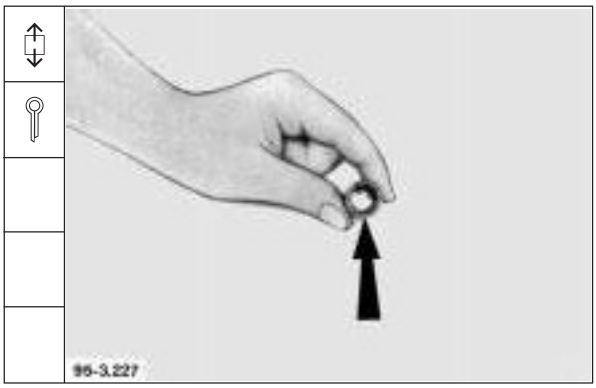
English	Français	Español
1. Take out coupling sleeve	1. Retirer la douille d'accouplement.	1. Sacar el manguito de acoplamiento.
2. Remove circlip.	2. Oter le circlip.	2. Retirar el anillo de retención.
3. Remove circlip.	3. Oter le circlip.	3. Retirar el anillo de retención.
4. Press out hydraulic pump gear.	4. Chasser le pignon de pompe hydraulique.	4. Desmontar a presión el engranaje de la bomba hidráulica.

Deutsch

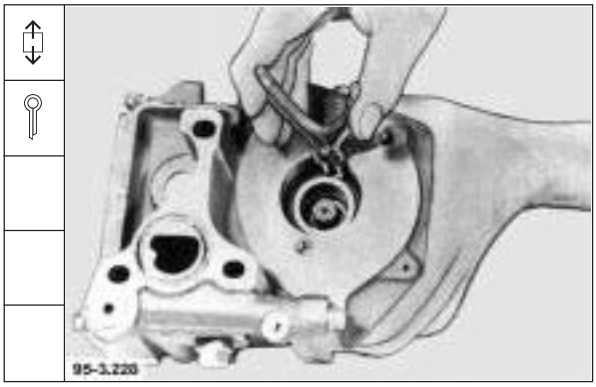
1. Kupplungshülse herausnehmen.



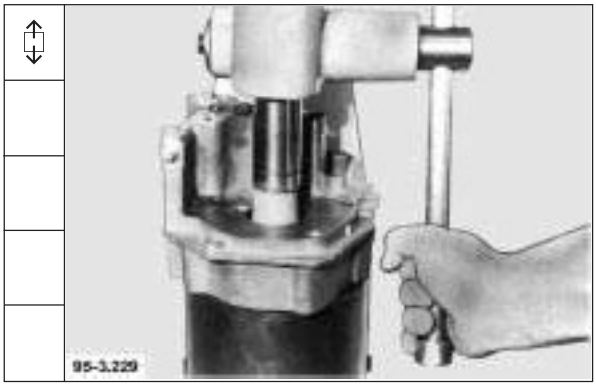
2. Sicherungsring entfernen



3. Sicherungsring entfernen.



4. Hydraulikpumpenzahnrad herausdrücken.



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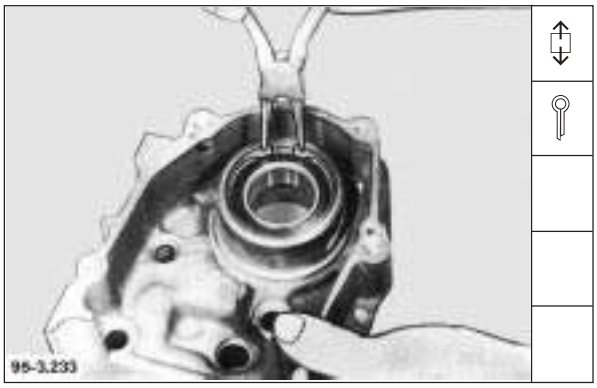
Deutsch

5. Verschlußdeckel abheben.

6. Zahnwelle herausdrücken.

7. Sicherungsring entfernen



8. Sicherungsring entfernen.

English	Français	Español
5. Lift off cover.	5. Soulever le couvercle.	5. Quitar la tapa de cierre.
6. Press out toothed shaft.	6. Chasser l'arbre cannelé.	6. Desmontar por presión el eje dentado.
7. Remove circlip.	7. Oter le circlip.	7. Quitar el anillo de retención.
8. Remove circlip.	8. Oter le circlip.	8. Quitar el anillo de retención.

English

9. Press out ball bearing.

10. Inspect component parts.

Note: Renew component parts, if necessary.

11. Press in ball bearing.

12. Insert circlip.

Français

9. Extraire le roulement à billes.

10. Contrôle visuel des différentes pièces.

Nota: au besoin renouveller les pièces.

11. Introduire le roulement à billes.

12. Mettre en place le circlip.

Español

9. Desmontar por presión el cojinete de bolas.

10. Examinar visualmente los componentes.

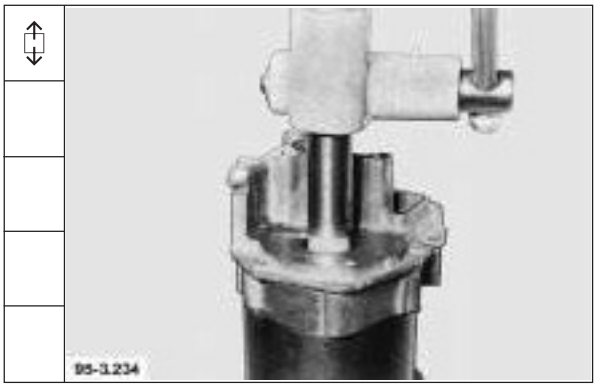
Nota: Sustituir los componentes en caso necesario.

11. Introducir a presión el cojinete de bolas.

12. Introducir el anillo de retención.

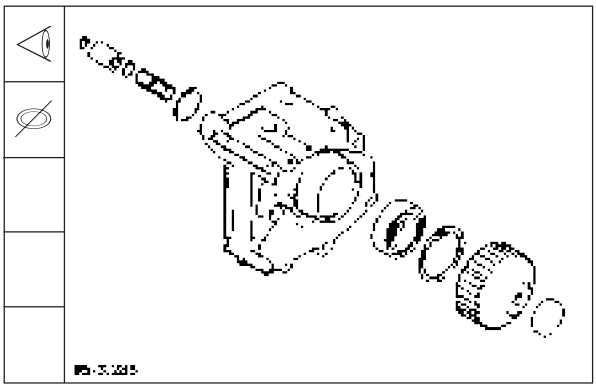
Deutsch

9. Kugellager herausdrücken.

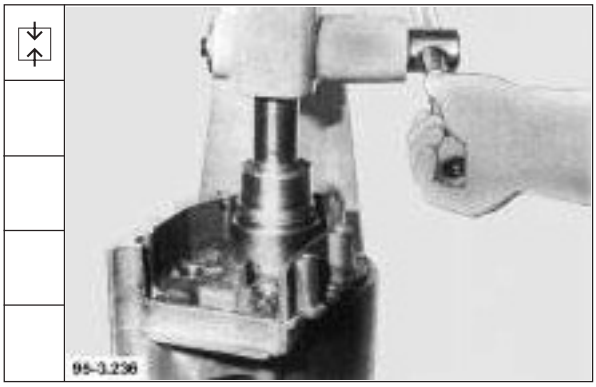


10. Einzelteile sichtprüfen.

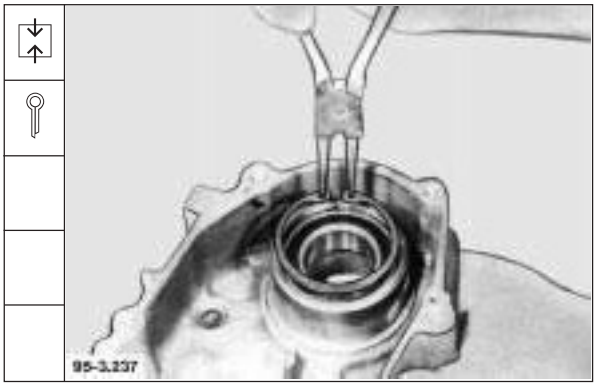
Hinweis: Einzelteile ggf. erneuern.



11. Kugellager eindrücken.



12. Sicherungsring einsetzen.



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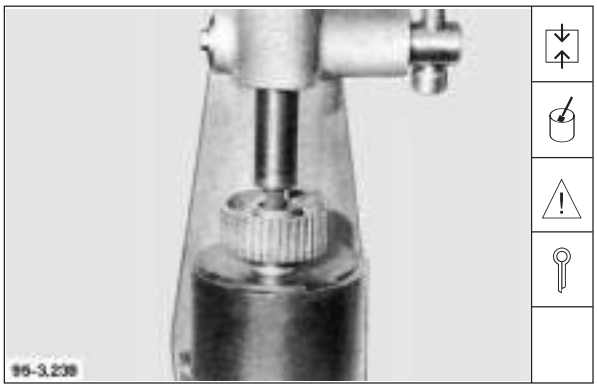
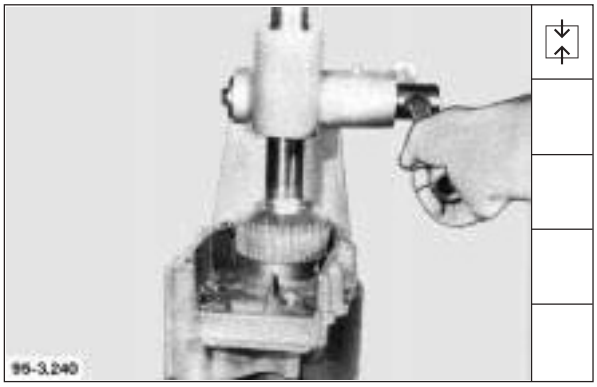
Deutsch

13. Sicherungsring auf Zahnwelle einsetzen.

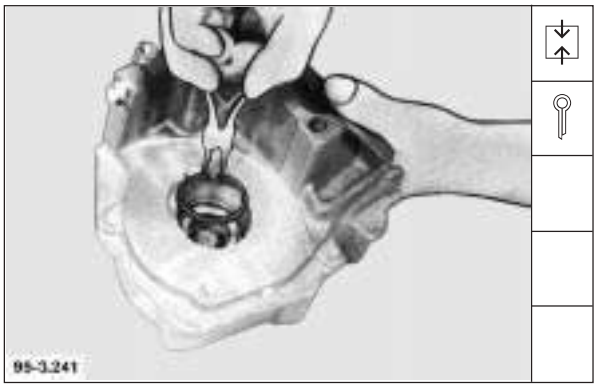


14. Zahnwelle mit Graphitfett eindrücken.

Hinweis: Auf Sicherungsring achten.



15. Hydraulikpumpenzahnrad eindrücken.



16. Sicherungsring einsetzen.

English

13. Place circlip on toothed shaft.

14. Press in toothed shaft with graphite grease.

Note: Pay attention to circlip.

15. Press in hydraulic pump gear.

16. Insert circlip.

Français

13. Placer circlip sur l'arbre cannelé.

14. Introduire l'arbre cannelé avec de la graisse au graphite.

Nota: attention au circlip!

15. Introduire le pignon de la pompe hydraulique.

16. Mettre en place le circlip.

Español

13. Montar el anillo de retención sobre el eje dentado.

14. Introducir a presión, con grasa grafitada, el eje dentado.

Nota: Prestar atención al anillo de retención.

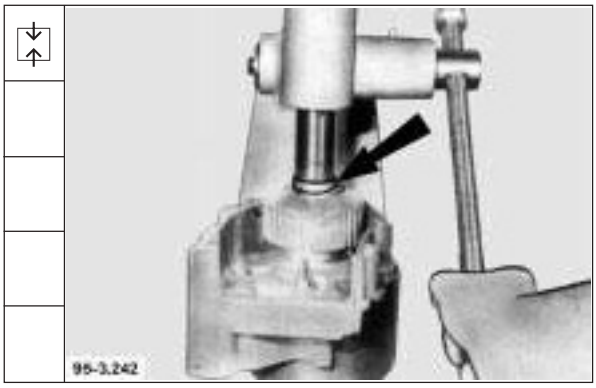
15. Introducir a presión el engranaje de la bomba hidráulica.

16. Montar el anillo de retención.

English	Français	Español
17. Press cover down.	17. Enfoncer le couvercle.	17. Montar a presión la tapa de cierre.
18. Insert circlip.	18. Placer le circlip.	18. Montar el anillo de retención.
19. Insert coupling sleeve with graphite grease.	19. Mettre en place la douille d'accouplement avec de la graisse au graphite.	19. Introducir el manguito de acoplamiento con grasa grafitada.

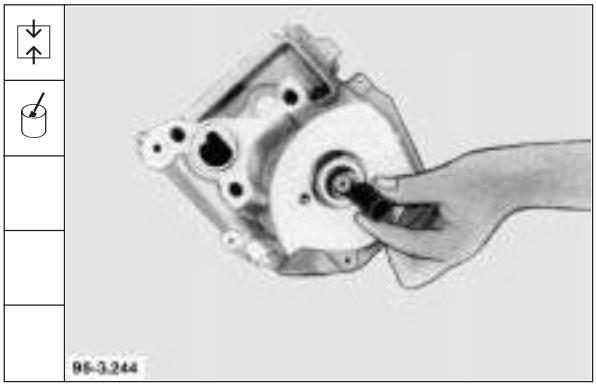
Deutsch

17. Verschlußdeckel aufdrücken.



18. Sicherungsring einsetzen.

19. Kupplungshülse mit Graphitfett einsetzen.



Demontage und Montage, Motor komplett

Disassembly and reassembly of complete engine

Démontage et montage moteur complet

Despiece y ensamblado conjunto de moteur

1011 F

DEUTZ

Deutsch

4. Demontage und Montage, Motor komplett

Werkstatthandbuch 1011 F

English

4. Disassembly and reassembly of complete engine

Français

4. Démontage et montage moteur complet

Werkstatthandbuch 1011 F

Español

4. Despiece y ensamblado conjunto de motor

English

Dismantling engine

Commercial tools required:

Torx tools	8189
Cobra clamp pliers	8011
Multipower tool	8049
Socket a/flats 32	8036

Special tools required:

Engine assembly stand	6067
Angled clamping plate	6067/115
Adjusting pin	100 700
Special wrench for injection line	110 490
Puller	143 100
Dolly	143 420
Intermediate disc	143 430
Dolly for camshaft gear	144 130
Special wrench for oil pressure sensor	170 110

The repair procedure outlined in this chapter refers to the standard specification, i.e. components for customizing the engine are not shown.

1. Remove mounting foot.

Français

Démontage du moteur

Outillage usuel:

Outils Torx	8189
Pince à ressorts Cobra	8011
Multiplicateur de couple	8049
Clé à douille de 32	8036

Outillage usuel:

Chevalet de montage de moteur	6067
Support d'ablocage	6067/115
Pige de réglage	100 700
Clé spéciale pour conduite d'injection	110 490
Outil à chasser	143 100
Dispositif d'immobilisation	143 420
Disque intermédiaire	143 430
Dispositif d'imobilisation pour pignon d'arbre à cames	144 130
Clé spéciale pour capteur de pression d'huile	170 110

Les travaux de réparation indiqués ne tiennent pas compte de la diversité des volumes de livraison des clients, c'est-à-dire que les pièces annexes différentes du modèle standard ne sont pas présentées dans le présent Manuel.

1. Déposer le pied de fixation.

Español

Desarmado del motor

Herramientas comerciales:

Herramental Torx	8189
Alicates Cobra para abrazaderas	8011
Multiplicador de fuerza	8049
Llave de vaso	8036

Herramientas especiales:

Caballete de montaje de motores	6067
Soporte de fijación	6067/115
Perno de ajuste	100 700
Llave especial para tuberías de inyección	110 490
Dispositivo de separación por presión	143 100
Contrasoporte	143 420
Arandela intermedia	143 430
Contrasoporte para la rueda dentada en el árbol de levas	144 130
Llave especial para transmisores de presión de aceite	170 110

Los trabajos de reparación ilustrados no consideran los diversos volúmenes de suministro según pedidos de clientes, o sea, elementos que difieren de la versión normal no se muestran.

1. Desmontar la pata de colocación.

Deutsch

Motor zerlegen

Handelsübliche Werkzeuge:

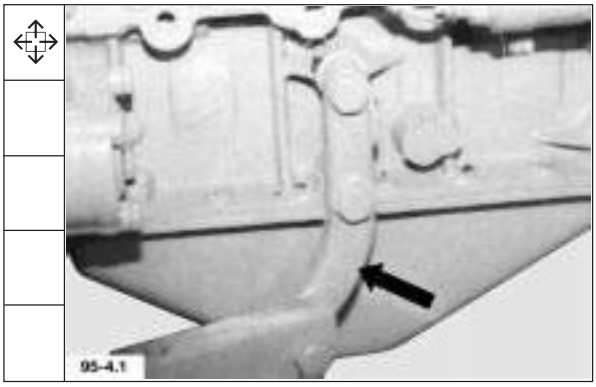
Torx-Werkzeuge	8189
Cobraklemmenzange	8011
Kraftvervielfältiger	8049
Stecknuß	8036

Spezialwerkzeuge:

Motor-Montagebock	6067
Aufspannhalter	6067/115
Einstellbolzen	100 700
Spezialschlüssel für Einspritzleitung	110 490
Abdrückvorrichtung	143 100
Gegenhalter	143 420
Zwischenscheibe	143 430
Gegenhalter für Nockenwellenrad	144 130
Spezialschlüssel für Öldruckgeber	170 110

Bei dem gezeigten Reparaturablauf sind unterschiedliche Kundenumfänge nicht berücksichtigt, d.h. von der Standard-Ausführung abweichende Anbauteile werden nicht gezeigt.

1. Aufstellfuß abbauen.



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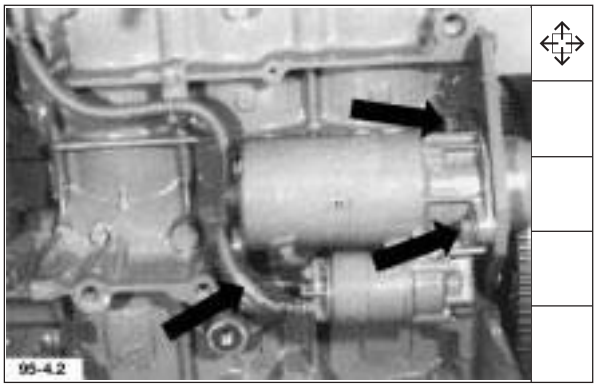
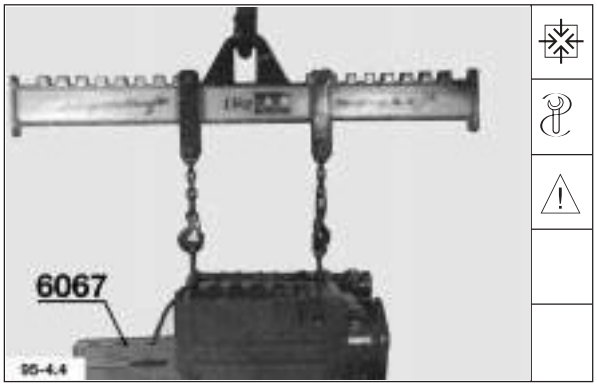
Deutsch



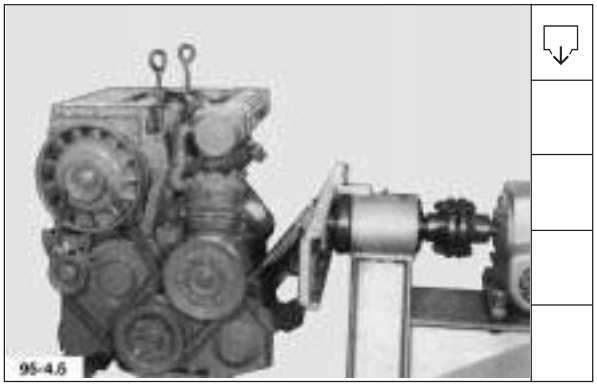
2. Ladestromleitung und Starter abbauen.

3. Aufspannhalter anbauen. Schrauben festdrehen.



4. Motor an schwenkbaren Montagebock montieren.

Hinweis: Richtige Aufhängevorrichtung verwenden.



5. Öl bzw. Restöl ablassen, auffangen und vorschriftsmäßig entsorgen.

English

2. Remove charging current line and starter.

3. Mount angled clamping plate. Tighten bolts.

4. Mount engine to swivelling assembly stand.

Note: Use proper suspension device.

5. Drain, catch remaining oil and dispose of in accordance with anti-pollution regulations.

Français

2. Déposer la conduite de courant de charge et le démarreur.

3. Monter le support d'ablocage et bloquer les vis.

4. Monter le moteur sur le chevalet de montage pivotable.

Nota: utiliser le bon dispositif de manutention.

5. Vidanger l'huile ou l'huile restante et s'en débarrasser selon la réglementation antipollution.

Español

2. Desmontar el cable de corriente de carga y el arrancador.

3. Montar el soporte de fijación. Apretar los tornillos.

4. Montar el motor sobre el caballete de montaje orientable.

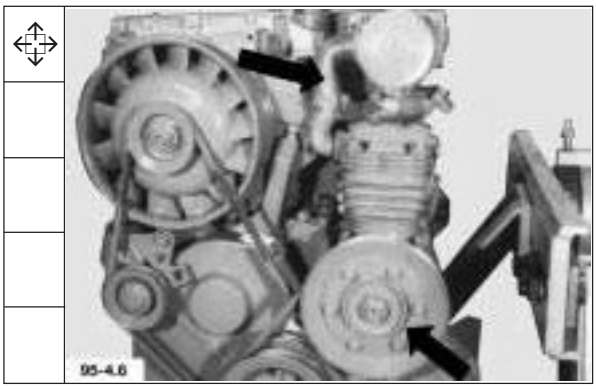
Nota: Usar el correcto dispositivo de suspensión.

5. Evacuar el aceite o aceite residual, recogerlo y eliminarlo en forma reglamentaria.

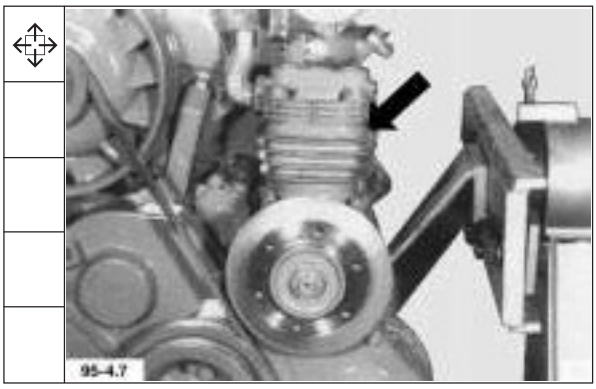
English	Français	Español
6. Remove hose elbow and V-belt pulley together with shims. Take off V-belt.	6. Déposer la tubulure flexible, la poulie à gorge et les rondelles de compensation. Retirer la courroie trapézoïdale.	6. Desmontar el codo de manguera y la polea de correa trapezoidal con arandelas de compensación.
7. Remove lube oil pipe and air compressor.	7. Déposer la canalisation d'huile et le compresseur d'air.	7. Desmontar la tubería de aceite lubricante y el compresor de aire.
8. Remove hydraulic pump.	8. Déposer la pompe hydraulique.	8. Desmontar la bomba hidráulica.
9. Remove V-belt idler pulley. Take off V-belt.	9. Déposer le galet tendeur de courroie et retirer cette dernière.	9. Desmontar la polea tensora de correa trapezoidal. Quitar la correa.

Deutsch

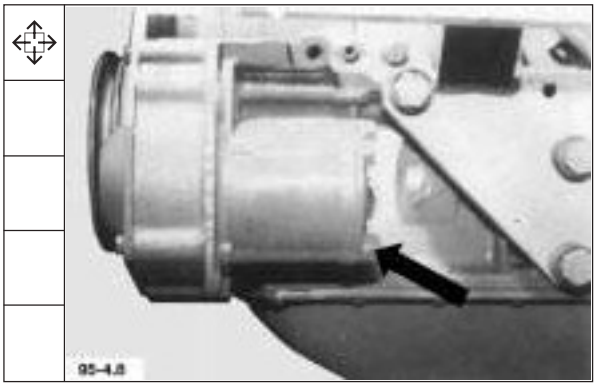
6. Schlauchkrümmer und Keilriemenscheibe mit Ausgleichscheiben abbauen. Keilriemen abnehmen.



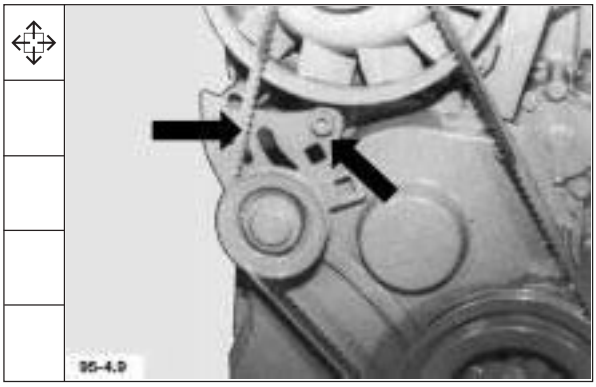
7. Schmierölleitung und Luftpresser abbauen.



8. Hydraulikpumpe abbauen.



9. Keilriemenspannrolle abbauen. Keilriemen abnehmen.



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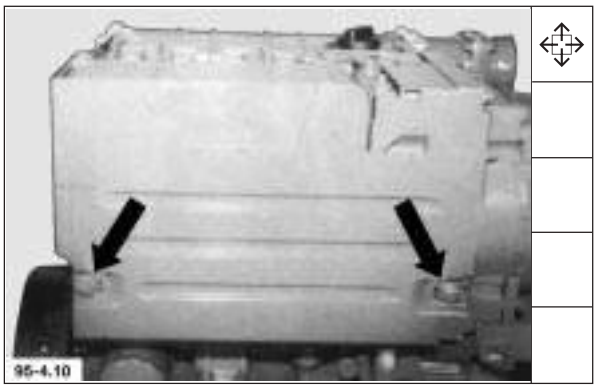
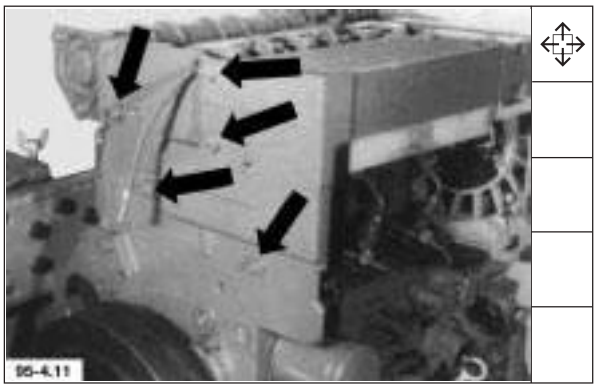
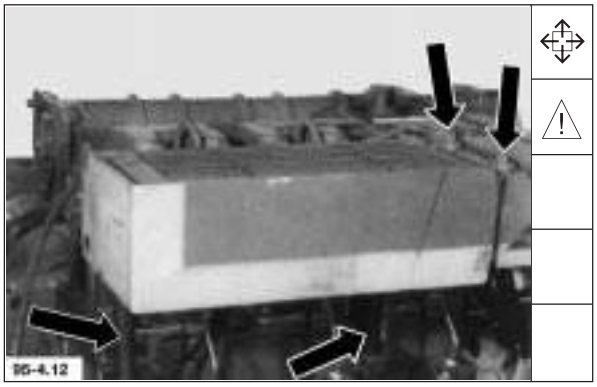
Deutsch



10. Luftführungshaube abbauen.

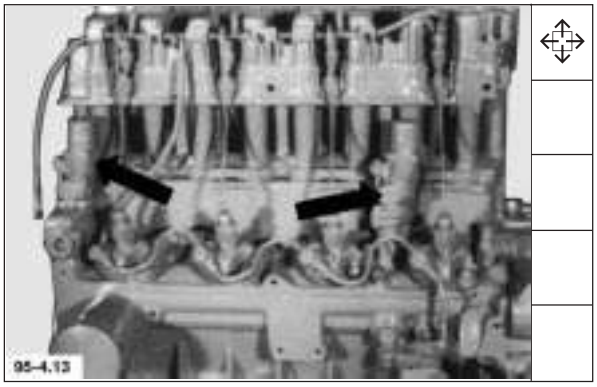


11. Standblech abbauen.



12. Ölkühler abbauen. Falls Steckstücke im Kurbelgehäuse verbleiben, Steckstücke herausnehmen.

Hinweis: Auslaufendes Öl auffangen und vorschriftsmäßig entsorgen.



Bei B/FM - Motoren.

13. Ölkühleranschlüsse abbauen.

English

10. Remove air cowling.

11. Remove stay plate.

12. Remove oil cooler. If plug-in elements have remained in the crankcase, take them out.

Note: Catch any escaping oil and dispose of in accordance with anti-pollution regulations.

With B/FM engines:

13. Remove oil cooler connections.

Français

10. Déposer la hotte de guidage d'air.

11. Déposer la tôle verticale.

12. Déposer le radiateur à huile. Au cas où des pièces intercalées seraient restées dans le bloc moteur, les retirer.

Nota: Recueillir l'huile qui s'écoule et s'en débarrasser selon la réglementation antipollution.

Pour moteurs B/FM

13. Déposer les raccords du radiateur à huile.

Español

10. Desmontar la manga guía de aire.

11. Desmontar la chapa vertical.

12. Desmontar el refrigerador de aceite. Retirar las piezas de enchufe que hayan quedado en el bloque motor.

Nota: Recoger el aceite que sale y eliminarlo en forma reglamentaria.

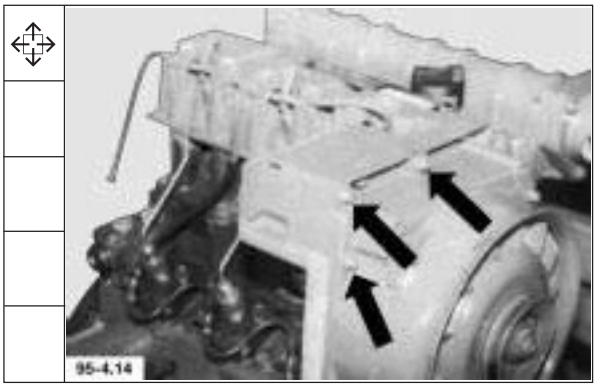
En motores B/FM:

13. Desmontar los racores del refrigerador de aceite.

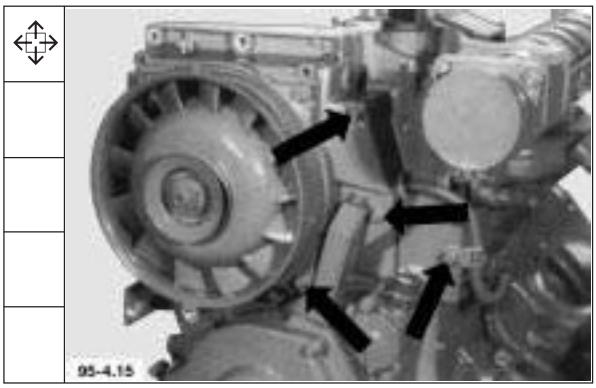
English	Français	Español
14. Remove air ducting.	14. Déposer le guidage d'air.	14. Desmontar la conducción de aire.
15. Remove blower with alternator and charging current line.	15. Déposer la turbine de refroidissement avec générateur et conduite de courant de charge.	15. Desmontar el ventilador de refrigeración con el alternador y cable de corriente de carga.
16. Remove exhaust manifold and air intake manifold.	16. Déposer le collecteur d'échappement et le collecteur d'admission.	16. Desmontar los colectores de escape y de admisión.
17. Remove injection lines.	17. Déposer les conduites d'injection.	17. Desmontar las tuberías de inyección.

Deutsch

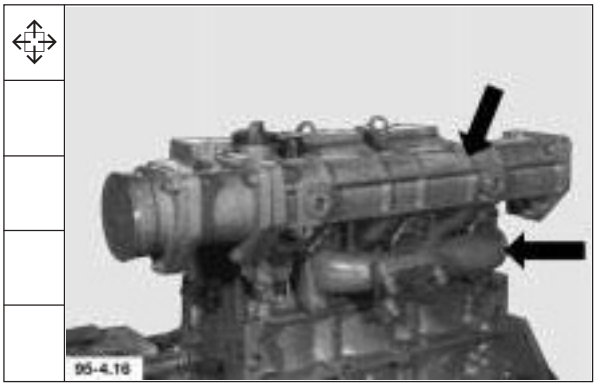
14. Luftführung abbauen.



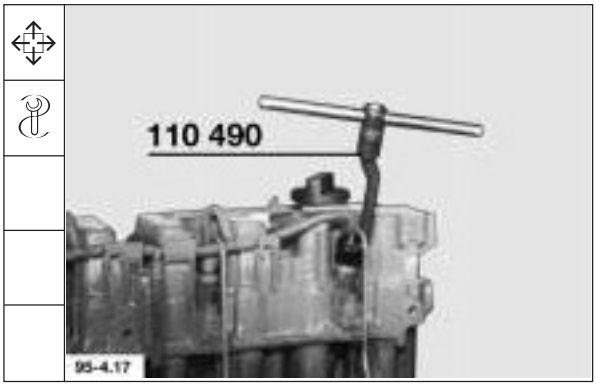
15. Kühlgebläse mit Generator und Ladestromleitung abbauen.



16. Abgassammelrohr und Luftansaugrohr abbauen.



17. Einspritzleitungen abbauen.



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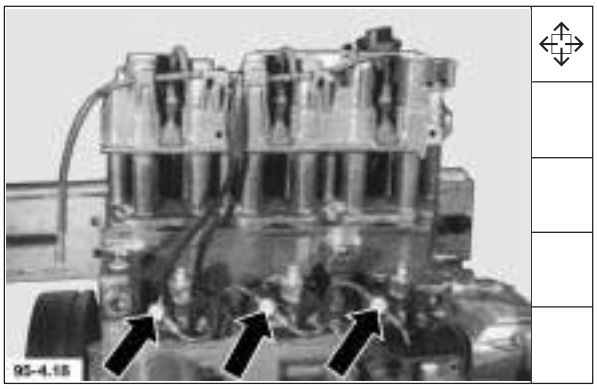
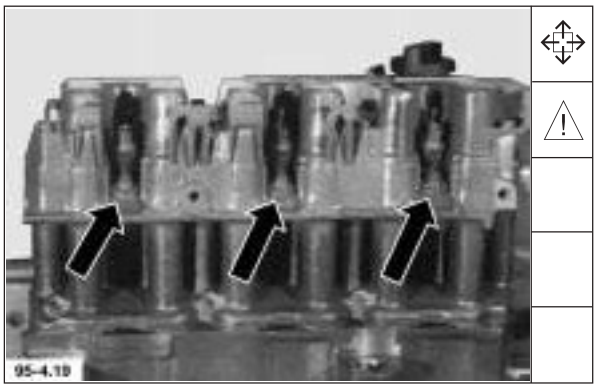
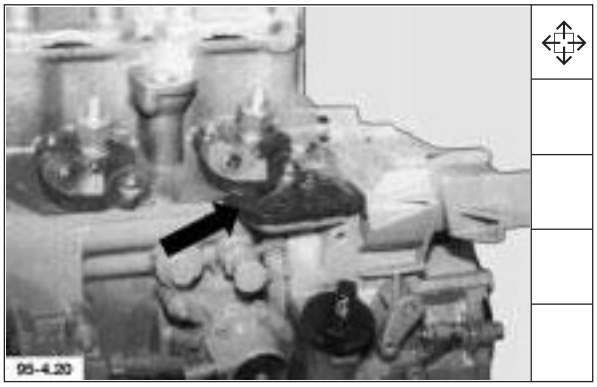


18. Leckölleitung abbauen.



19. Spannpratzen entfernen. Einspritzventile ausbauen.

Hinweis: Anschlüsse verschließen.



20. Profilgummi entfernen.

21. Kraftstoffleitungen abbauen. Ölmeßstab entfernen.

Hinweis: Cobraklemmenzange benutzen.

English

18. Remove leakage fuel pipe.

19. Remove clamping pads. Remove injectors.

Note: Cover up connections.

20. Remove rubber profile.

21. Remove fuel lines. Remove oil dipstick.

Note: Use Cobra clamp pliers.

Français

18. Déposer la tubulure de récupération des fuites.

19. Oter les pattes de serrage et déposer les injecteurs.

Nota: boucher les orifices.

20. Oter le caoutchouc profilé.

21. Déposer les conduites d'alimentation et retirer la jauge d'huile.

Nota: utiliser une pince à ressorts Cobra pour tuyaux.

Español

18. Desmontar la tubería de combustible sobrante.

19. Quitar las garras de sujeción. Desmontar los inyectores.

Nota: Cerrar las aberturas.

20. Quitar los perfiles de goma.

21. Desmontar las tuberías de combustible. Retirar la varilla para la medición del nivel de aceite.

Nota: Usar los alicates Cobra para abrazaderas.

English

22. Remove oil filter.

Note: Catch any escaping oil and dispose of in accordance with anti-pollution regulations.

23. Remove fuel filter.

Note: Catch any escaping fuel and dispose of in accordance with anti-pollution regulations.

24. Remove fuel filter bracket and fuel feed pump.

25. Remove mounting foot.

Français

22. Déposer le filtre à huile.

Nota: recueillir l'huile qui s'écoule et s'en débarrasser selon la réglementation antipollution.

23. Déposer le filtre à combustible.

Nota: recueillir l'huile qui s'écoule et assurer son élimination selon la réglementation antipollution.

24. Déposer console du filtre à combustible et pompe d'alimentation.

25. Déposer pied de fixation.

Español

22. Desmontar el filtro de aceite.

Nota: Recoger el aceite que sale y eliminarlo en forma reglamentaria.

23. Desmontar el filtro de combustible.

Nota: Recoger el combustible que sale y eliminarlo en forma reglamentaria.

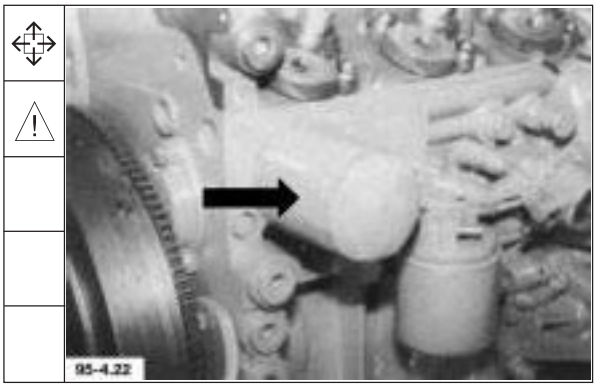
24. Desmontar la consola del filtro de combustible y la bomba de alimentación de combustible.

25. Desmontar la pata de colocación.

Deutsch

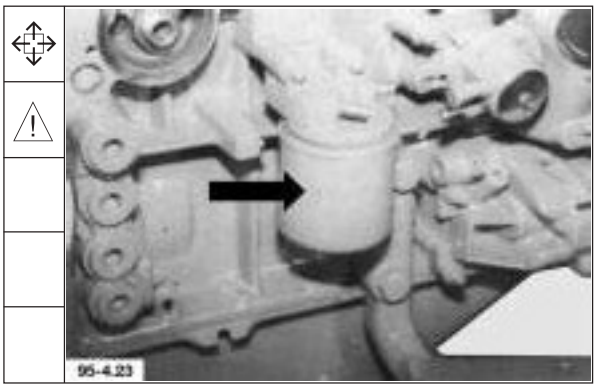
22. Ölfilter abbauen.

Hinweis: Auslaufendes Öl auffangen und vorschriftsmäßig entsorgen.

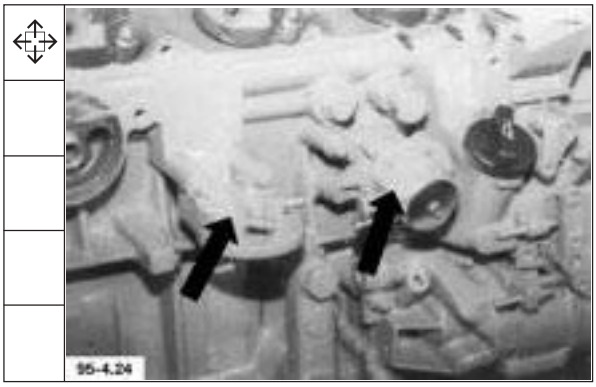


23. Kraftstoffilter abbauen.

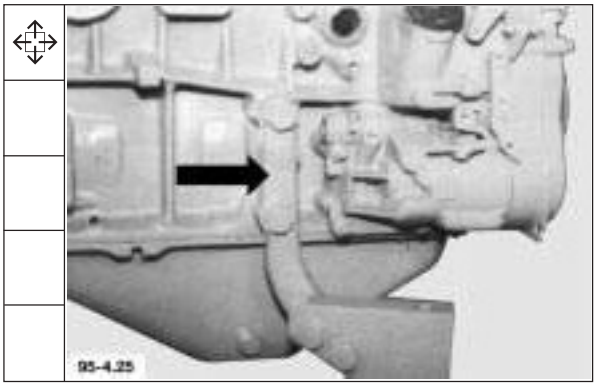
Hinweis: Auslaufender Kraftstoff auffangen und vorschriftsmäßig entsorgen.



24. Kraftstoffilterkonsole und Kraftstofförderpumpe abbauen.



25. Aufstellfuß abbauen.



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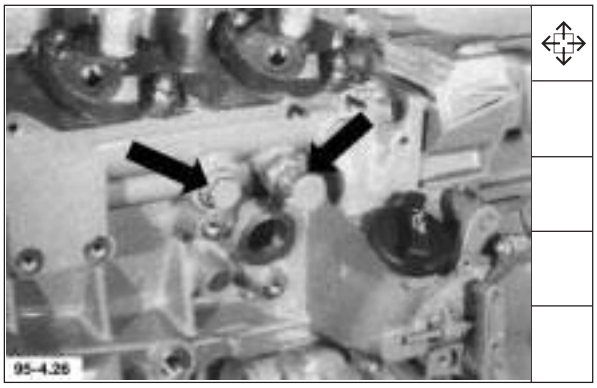
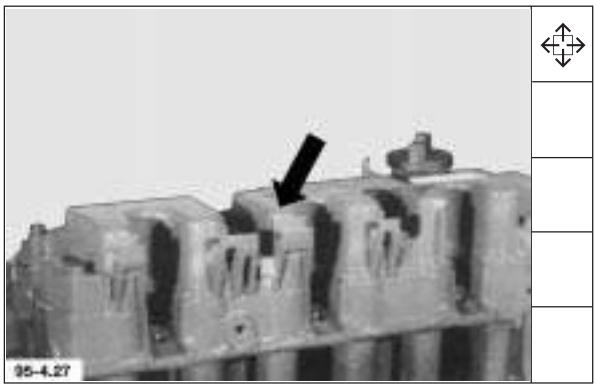
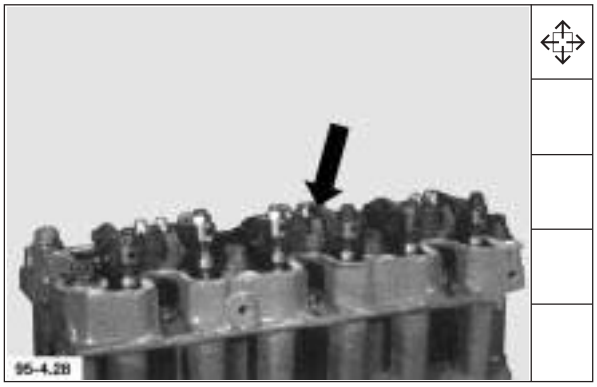


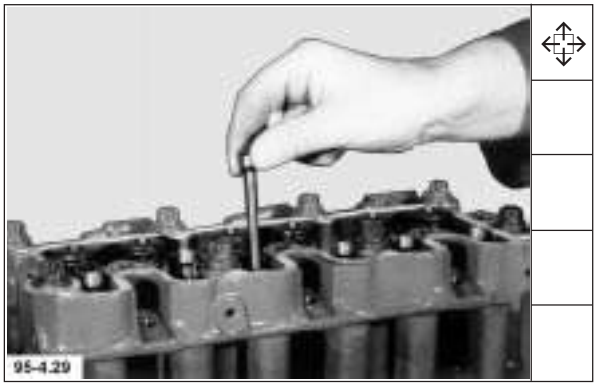
26. Öldruckgeber und Verschlußschraube herausschrauben.



27. Zylinderkopfhaube abbauen.



28. Kipphebelböcke abbauen.



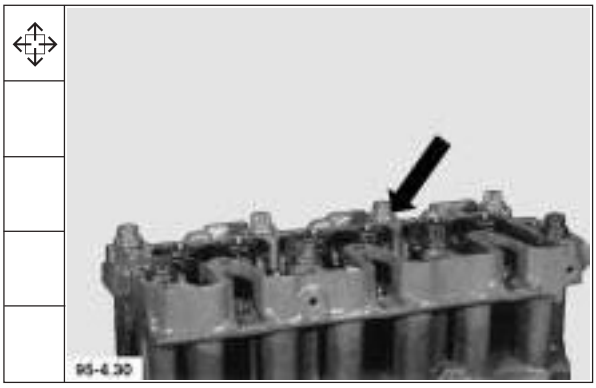
29. Stoßstangen herausnehmen.

English	Français	Español
26. Unscrew oil pressure sensor and screw plug.	26. Dévisser capteur d'huile de pression et vis filetée.	26. Desenroscar el transmisor de presión de aceite y el tapón.
27. Remove cylinder head cover.	27. Déposer la culasse.	27. Desmontar la tapa de culata.
28. Remove rocker arm brackets.	28. Déposer les supports de culbuteurs.	28. Desmontar los soportes de balancines.
29. Take out pushrods.	29. Retirer les tiges de culbuteurs.	29. Sacar las varillas de empuje.

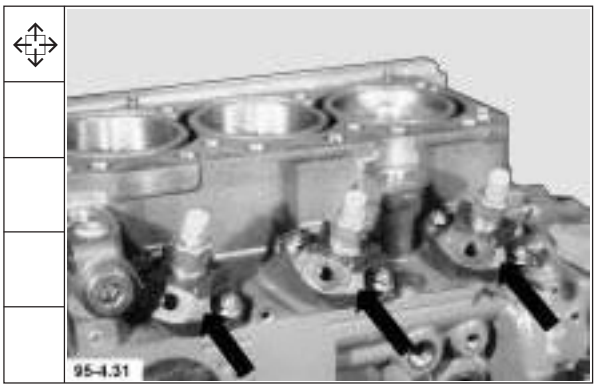
English	Français	Español
30. Remove cylinder head.	30. Déposer la culasse.	30. Desmontar la culata.
31. Remove injection pumps.	31. Déposer les pompes d'injection.	31. Desmontar las bombas de inyección.
32. Take out roller tappets for injection pump (using outer circlip pliers).	32. Retirer le poussoir à galets de la pompe d'injection (à l'aide de la pince d'extérieur).	32. Sacar el empujador de rodillo de la bomba de inyección (con ayuda de unos alicates de seguridad exterior).
33. Remove thermostat.	33. Déposer le thermostat.	33. Desmontar el termostato.

Deutsch

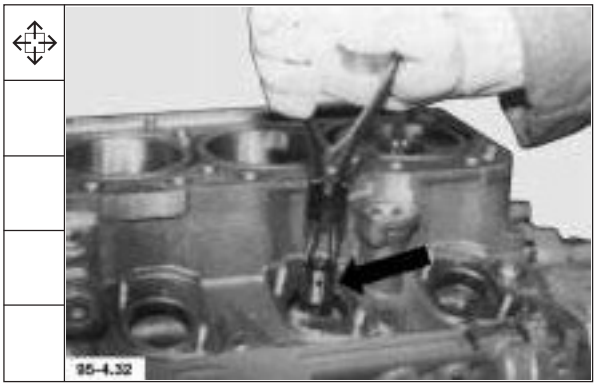
30. Zylinderkopf abbauen.



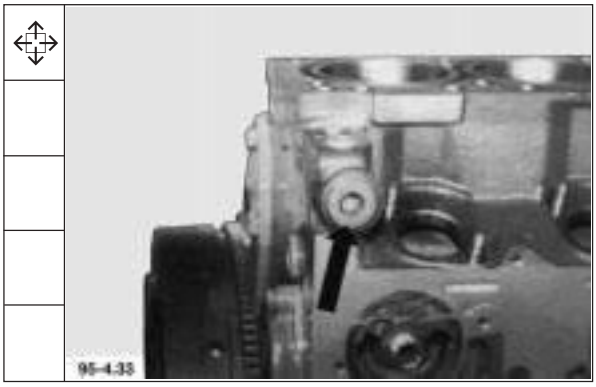
31. Einspritzpumpen ausbauen.



32. Rollenstößel für Einspritzpumpe (mit Hilfe einer Außensicherungszange) herausnehmen.



33. Thermostat ausbauen.



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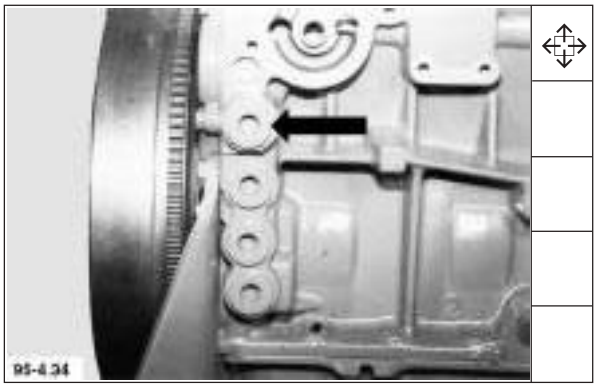
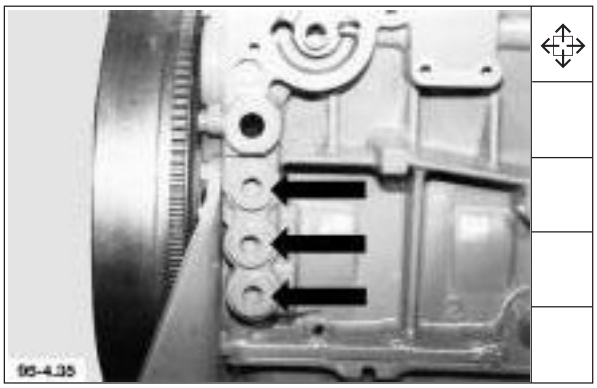
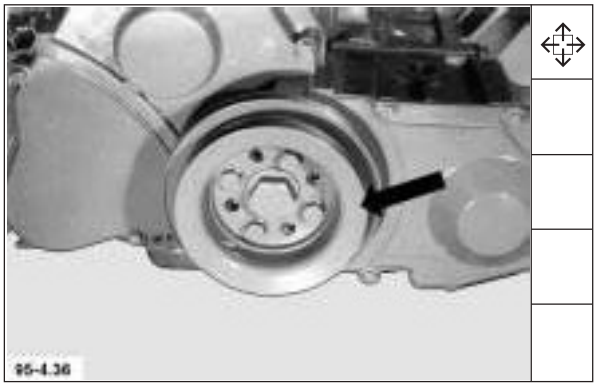


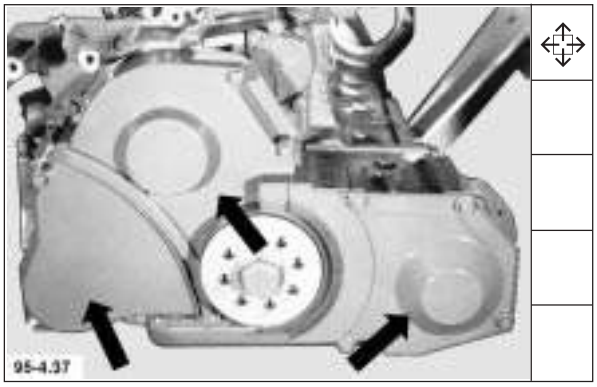
34. Öldruckventil ausbauen.



35. Verschlußschrauben herausschrauben. Falls Heizungsanschluß vorhanden, Öldruckventile herausnehmen.



36. Riemenscheibe abbauen.



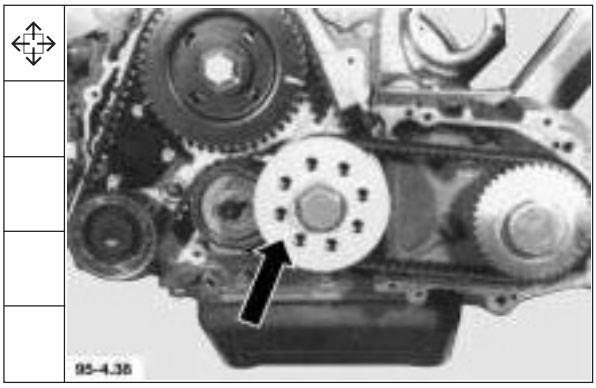
37. Zahnriemenschutzgehäuse abbauen.

English	Français	Español
34. Remove oil pressure control valve.	34. Déposer la soupape de régulation de pression d'huile.	34. Desmontar la válvula de presión de aceite.
35. Unscrew screw plugs. If heater connection is provided, take out oil pressure control valves.	35. Dévisser les vis filetées. En présence d'un raccord de chauffage, retirer les soupapes de régulation de pression d'huile.	35. Desenroscar los tapones. Si existe un empalme de calefacción, retirar las válvulas de presión de aceite.
36. Remove belt pulley.	36. Monter la poulie à gorge.	36. Desmontar la polea de correa trapezoidal.
37. Remove toothed belt guard.	37. Déposer le carter cache-courroie.	37. Desmontar la cubierta protectora de correas dentadas.

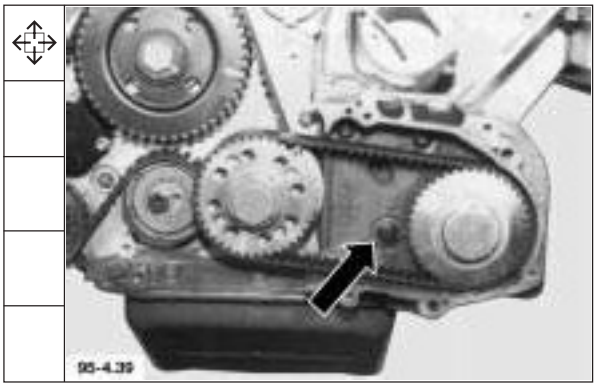
English	Français	Español
38. Take off intermediate disc.	38. Retirer la poulie intermédiaire.	38. Quitar la arandela intermedia.
39. Remove hydraulic pump bracket. Remove toothed belt.	39. Déposer la console de la pompe hydraulique et ôter la courroie dentée.	39. Desmontar el soporte de la bomba hidráulica. Quitar la correa dentada.
40. Remove idler pulley. Remove toothed belt.	40. Déposer le galet tendeur et ôter la courroie dentée.	40. Desmontar la polea tensora. Quitar la correa dentada.
41. Remove camshaft gear.	41. Déposer le pignon d'arbre à cames.	41. Desmontar la rueda dentada del árbol de levas.

Deutsch

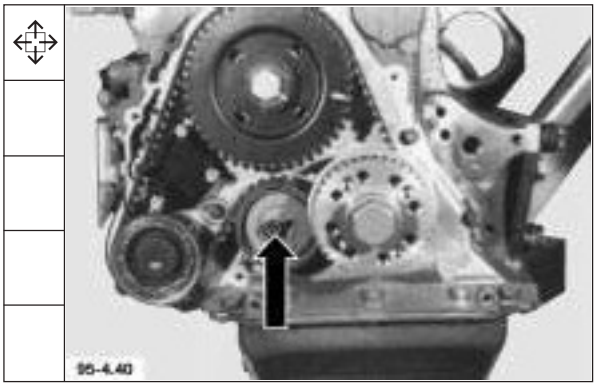
38. Zwischenscheibe abnehmen.



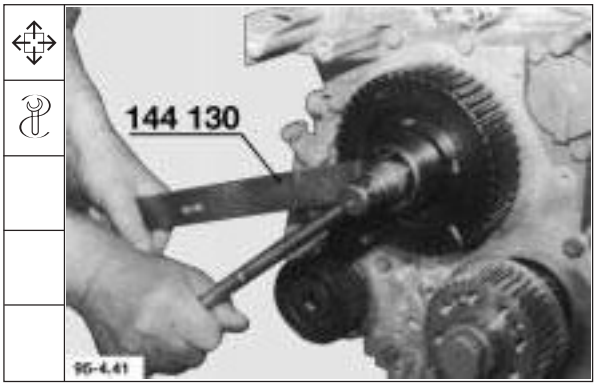
39. Hydraulikpumpenkonsole abbauen. Zahnriemen entfernen.



40. Spannrolle abbauen. Zahnriemen entfernen.



41. Nockenwellenzahnrad abbauen.



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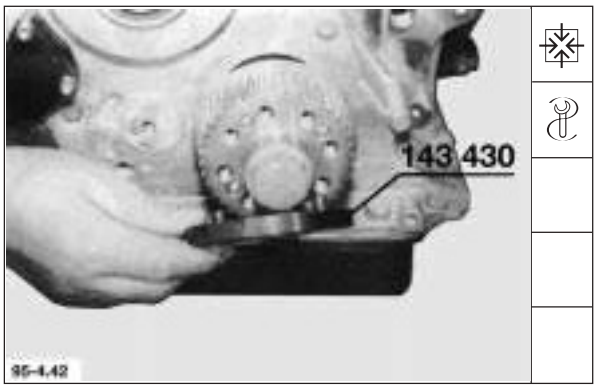
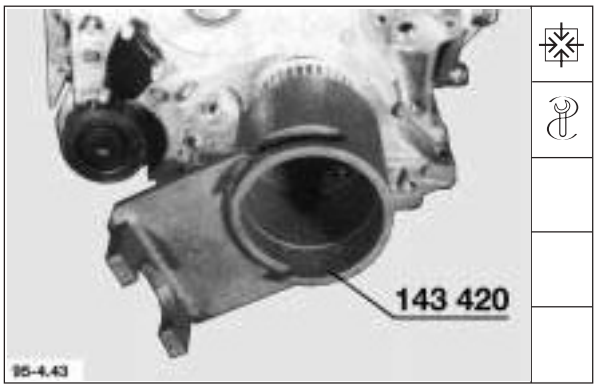
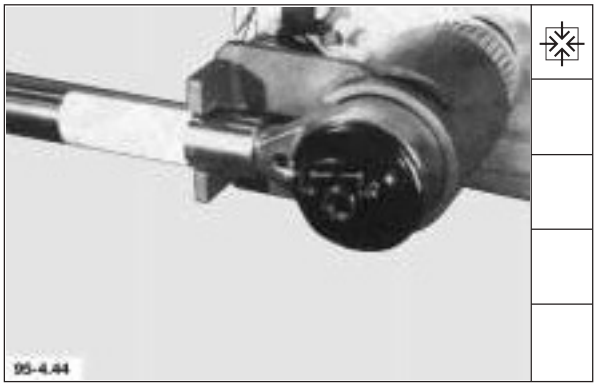
Deutsch



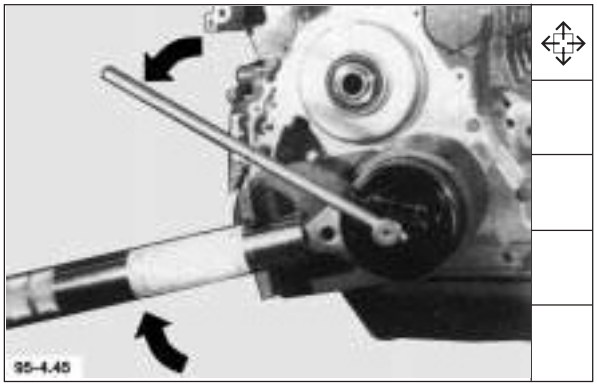
42. Zwischenscheibe aufsetzen.



43. Gegenhalter für Kurbelwellenzahnrad anbauen und Schrauben festdrehen.



44. Kraftvervielfälltiger mit Stecknuß (60 IMP) ansetzen.



45. Kraftvervielfälltiger gegenhalten und Zentralschraube lösen. Zahnräder abnehmen.

English	Français	Español
42. Position intermediate disc.	42. Placer la poulie intermédiaire.	42. Colocar la arandela intermedia.
43. Fit dolly for crankshaft gear and tighten bolts.	43. Monter le dispositif d'immobilisation du pignon du vilebrequin puis bloquer les vis.	43. Montar el contrasoporte de la rueda dentada situada en el cigüeñal y apretar los tornillos.
44. Position multipower tool with socket (60 IMP).	44. Placer le multiplicateur de couple avec la douille (60 IMP).	44. Posicionar el multiplicador de fuerza con la llave de vaso (60 IMP) puesta.
45. Retain multipower tool and loosen central bolt. Take off gears.	45. Placer et maintenir le multiplicateur de force. Desserrer la vis centrale. Déposer les pignons.	45. Retener el multiplicador de fuerza y soltar el tornillo central. Desmontar las ruedas dentadas.

English

46. Remove lube oil pump.

Note: Catch any escaping oil and dispose of in accordance with anti-pollution regulations.

47. Turn engine by **180**°. Take off oil pan.

48. Remove oil suction pipe.

49. Remove piston complete with connecting rod.

Note: Loosen conrod nut with **dodecagonal** socket wrench.

Français

46. Déposer la pompe à huile.

Nota: recueillir l'huile qui s'écoule et assurer son élimination selon la réglementation antipollution.

47. Virer le moteur de **180**° et déposer le carter d'huile.

48. Déposer le tube d'aspiration d'huile.

49. Déposer l'ensemble piston-bielle.

Nota: desserrer l'écrou de la bielle à l'aide la clé à douille à **12** pans.

Español

46. Desmontar la bomba de aceite lubricante.

Nota: Recoger el aceite que sale y eliminarlo en forma reglamentaria.

47. Girar el motor **180**°. Desmontar el cárter de aceite.

48. Desmontar el tubo de aspiración de aceite.

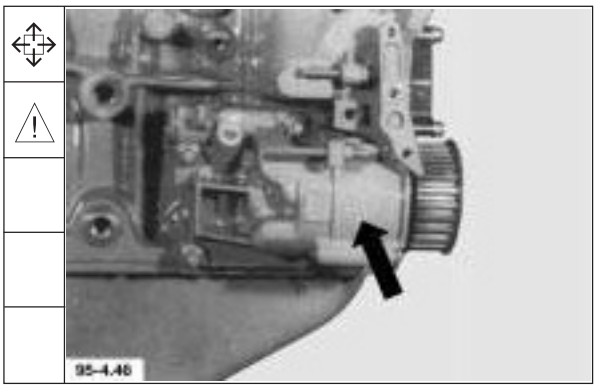
49. Desmontar el pistón con la biela.

Nota: Soltar las tuercas de biela con ayuda de una llave de vaso de **12** cantos.

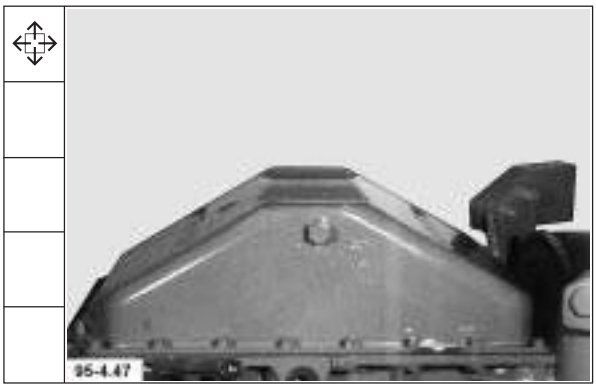
Deutsch

46. Schmierölpumpe abbauen.

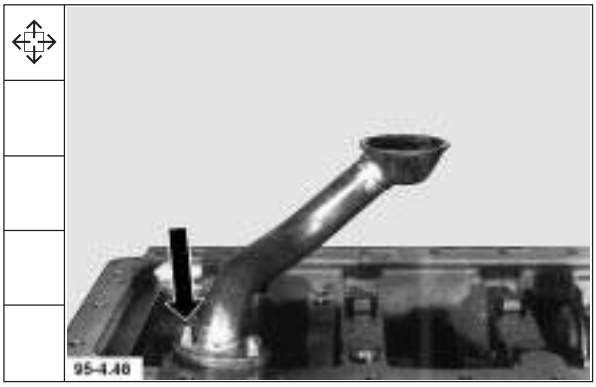
Hinweis: Auslaufendes Öl auffangen und vorschriftsmäßig entsorgen.



47. Motor um **180**° drehen. Ölwanne abbauen.

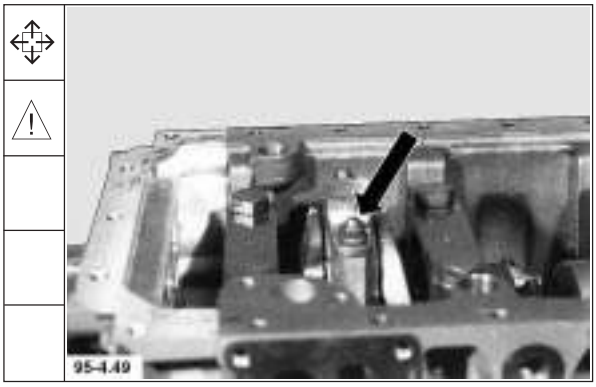


48. Ölansaugrohr abbauen.



49. Kolben mit Pleuel ausbauen.

Hinweis: Pleuelmuttern mit **12**- kant Steckschlüssel lösen.



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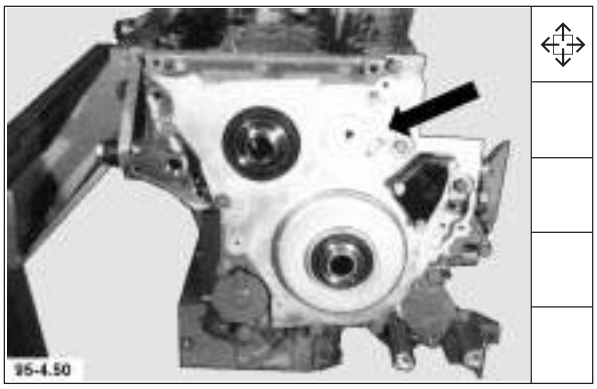
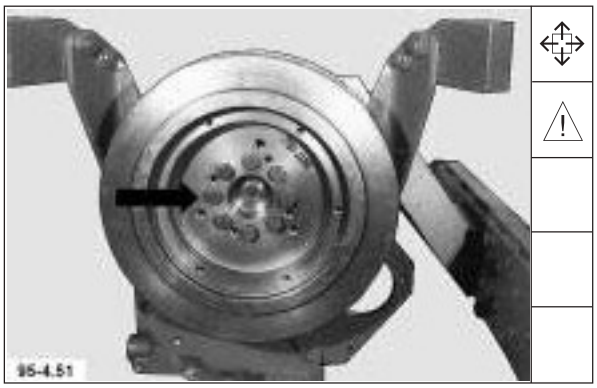
Deutsch

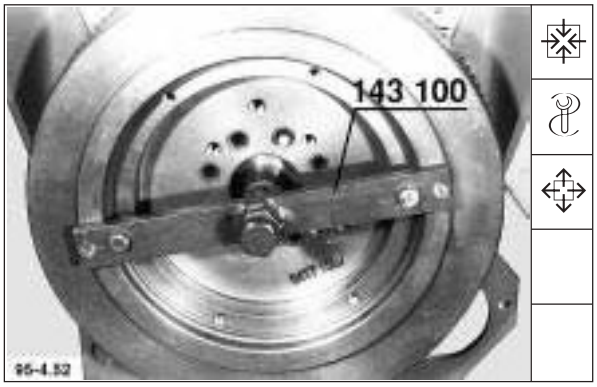


50. Vorderen Deckel abbauen.

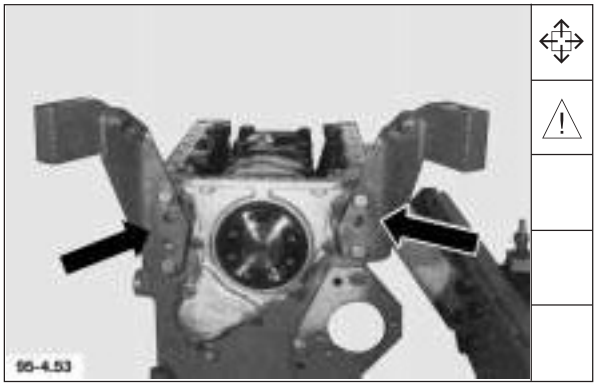


51. Schwungradschrauben lösen und entfernen.

Hinweis: Selbstgefertigten Führungsdorn verwenden.



52. Falls Schwungrad festsitzt, Schwungradabzieher anbauen. Schwungrad abdrücken.



53. Aufstellfüße abbauen.

Hinweis: Falls vorhanden, Anschlußgehäuse abbauen.

English

50. Take off front cover.

51. Undo and remove flywheel bolts.

Note: Use self-made pilot bar.

52. If flywheel is stuck, fit flywheel puller. Press off flywheel.

53. Remove mounting feet.

Note: Remove adapter housing, if any.

Français

50. Déposer le couvercle avant.

51. Desserrer et ôter les vis du volant moteur.

Nota: utiliser un mandrin de guidage de fabrication locale.

52. Si le volant moteur est bloqué, monter un extracteur pour chasser le volant.

53. Déposer les pieds de fixation.

Nota: si le moteur en est équipé d'un, déposer le carter d'adaptation.

Español

50. Desmontar la tapa delantera.

51. Soltar y quitar los tornillos del volante.

Nota: Usar el mandril de guía de confección propia.

52. En caso de firme asiento del volante, montar el dispositivo de extracción. Separar por presión el volante.

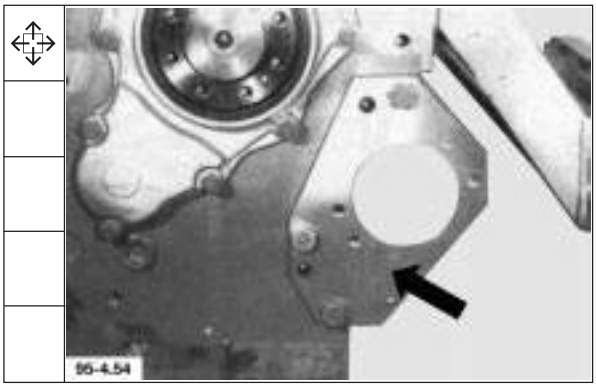
53. Desmontar las patas de colocación.

Nota: Si existe, desmontar el cárter de adaptación.

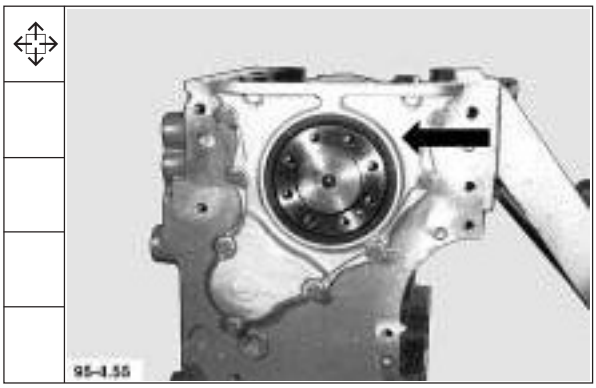
English	Français	Español
54. Remove starter bracket.	54. Déposer la console du démarreur.	54. Desmontar la consola para el arrancador.
55. Take off rear cover.	55. Déposer le couvercle arrière.	55. Desmontar la tapa trasera.
56. Screw in adjusting pin for camshaft. Take off thrust washer for camshaft.	56. Introduire la pige de réglage de l'arbre à cames. Déposer la rondelle de butée de l'arbre à cames.	56. Enroscar el perno de ajuste del árbol de levas. Desmontar la arandela de tope del árbol de levas.
57. Remove camshaft.	57. Déposer l'arbre à cames.	57. Sacar el árbol de levas.

Deutsch

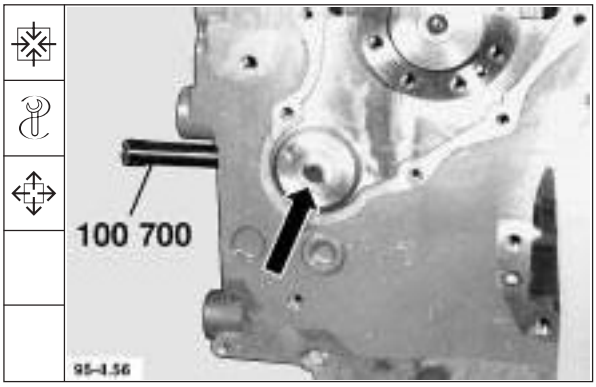
54. Konsole für Starter abbauen.



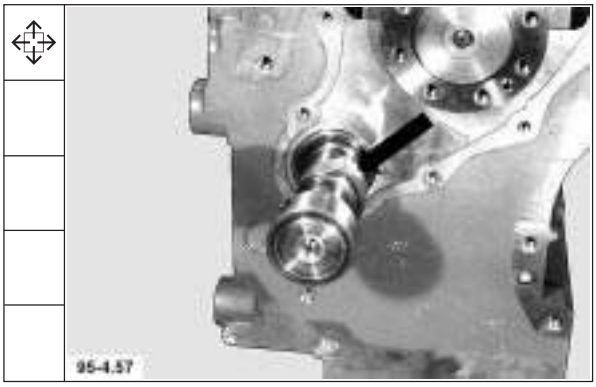
55. Hinteren Deckel abbauen.



56. Einstellbolzen für Nockenwelle einschrauben.
Anlaufscheibe für Nockenwelle abbauen.



57. Nockenwelle ausbauen.



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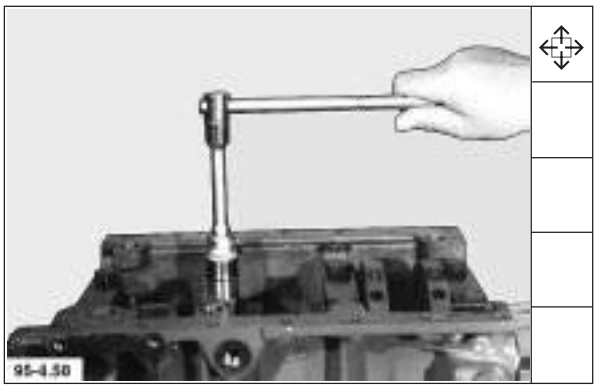
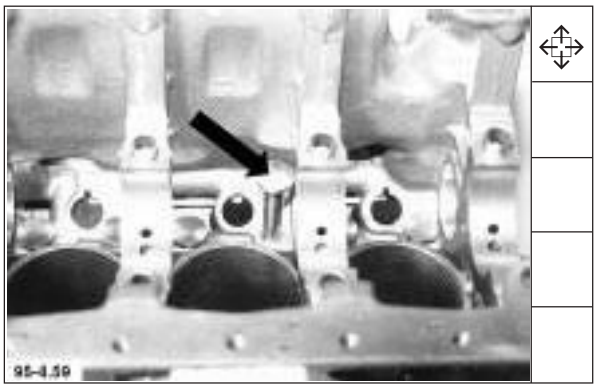
Deutsch



58. Hauptlagerdeckel ausbauen. Kurbelwelle herausnehmen.



59. Stößel herausnehmen.

English	Français	Español
58. Remove main bearing caps.	58. Déposer les chapeaux de paliers puis retirer le vilebrequin.	58. Quitar las tapas de los cojinetes de apoyo. Sacar el cigüeñal.
59. Take out tappets.	58. Retirer les poussoirs.	59. Retirar los empujadores.

English

Reassembling engine

Commercial tools required:

Torx tools	8189
Hose clamp pliers	9088
Cobra clamp pliers	8011
V-belt tension gauge	8115
Multipower tool	8049
Socket a/flats 32	8036
Spring clamp pliers	9090

Special tools required:

Adjusting pin	100 700
Adjusting pin	100 710
Toothed belt tension gauge	100 720
Locking wire for injection pump	100 870
Locking wire for injection pump	100 880
Gauge	100 750
Test template for I.P. gasket	103 020
Special wrench for injection line	110 490
Piston ring compressor	130 510
Dolly	143 420
Intermediate disc	143 430
Dolly for camshaft gear	144 130
Tensioning device for toothed belt	144 600
Special wrench for oil pressure sensor	170 110

Thermostat

1. Fit thermostat with compression spring.

2. Tighten screw plug with new O-seal.

   Tightening specification: **75 Nm**

Note: For fitting the O-seal cover thread with assembly sleeve.

Français

Assemblage du moteur

Outillage usuel:

Outils Torx	8189
Pince à tuyaux flexibles	9088
Pince à ressorts Cobra pour tuyaux	8011
Appareil de mesure de la tension de courroie	8115
Multiplicateur de force	8049
Douille de 32	8036
Pince à ressorts	9090

Outillage spécial:

Pige de calage	100 700
Pige de calage	100 710
Appareil de mesure de tension de courroie crantée	100 720
Fil d'arrêt pour pompe d'injection	100 870
Fil d'arrêt pour pompe d'injection	100 880
Appareil de mesure	100 750
Gabarit de contrôle pour joint de pompe d'injection	103 020
Clé spéciale pour conduite d'injection	110 490
Sangle à comprimer les pistons	130 510
Outil de maintien	143 420
Rondelle intermédiaire	143 430
Outil de maintien de pignon d'arbre à cames	144 130
Dispositif de serrage pour courroie crantée	144 600
Clé spéciale pour capteur de pression d'huile	170 110

Thermostat

1. Monter le thermostat avec le ressort de pression.

2. Serrer la vis filetée en utilisant un joint torique neuf.

   Consigne de serrage: **75 Nm**

Nota: pour le montage du joint torique recouvrir le filet avec la douille de montage.

Español

Rearmado del motor

Herramientas comerciales:

Herramental Torx	8189
Alicates para abrazaderas de mangueras	9088
Alicates Cobra para abrazaderas	8011
Verificador de tensión de correas trapezoidales	8115
Multiplicador de fuerza	8049
Llave de vaso	8036
Alicates para abrazaderas de resorte	9090

Herramientas especiales:

Perno de ajuste	100 700
Perno de ajuste	100 710
Verificador de tensión de correas dentadas	100 720
Alambre de sujeción p. bombas inyección	100 870
Alambre de sujeción p. bombas inyección	100 880
Dispositivo de medición	100 750
Plantilla para comprobar juntas de b.i.	103 020
Llave especial para tuberías de inyección	110 490
Compresor de aros de pistón	130 510
Contrasoporte	143 420
Arandela intermedia	143 430
Contrasoporte para la rueda dentada en el árbol de levas	144 130
Tensor de correas dentadas	144 600
Llave especial para transmisores de presión de aceite	170 110

Termostato

1. Instalar el termostato con muelle de presión.

2. Apretar el tapón con un anillo tórico nuevo.

   Prescripción de apriete: **75 Nm**

Nota: Para el montaje del anillo tórico hay que cubrir la rosca mediante el manguito de montaje.

Deutsch

Motor zusammenbauen

Handelübliche Werkzeuge:

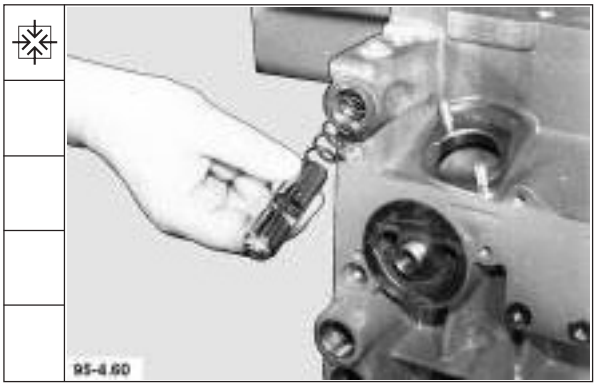
Torx-Werkzeuge	8189
Schlauchklemmen-Zange	9088
Cobraklemmenzange	8011
Keilriemenspannungs-Meßgerät	8015
Kraftvervielfältiger	8049
Stecknuß	8036
Federklemmenzange	9090

Spezialwerkzeuge:

Einstellbolzen	100 700
Einstellbolzen	100 710
Zahnriemenspannungs-Meßgerät	100 720
Arretierungsdraht für Einspritzpumpe	100 870
Arretierungsdraht für Einspritzpumpe	100 880
Meßgerät	100 750
Prüfschablone für E.P.-Dichtung	103 020
Spezialschlüssel für Einspritzleitung	110 490
Kolbenringspannband	130 510
Gegenhalter	143 420
Zwischenscheibe	143 430
Gegenhalter für Nockenwellenrad	144 130
Spannvorrichtung für Zahnriemen	144 600
Spezialschlüssel für Öldruckgeber	170 110

Thermostat

1. Thermostat mit Druckfeder einbauen.



2. Verschlußschraube mit neuem Runddichtring festdrehen.

   Anziehvorschrift: **75 Nm**

Hinweis: Für Montage des Runddichtringes Gewinde mit Montagehülse abdecken.

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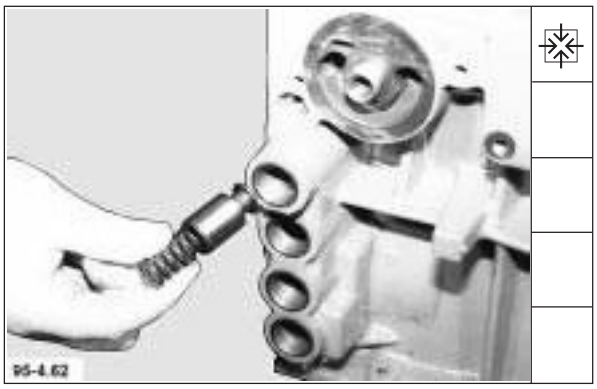
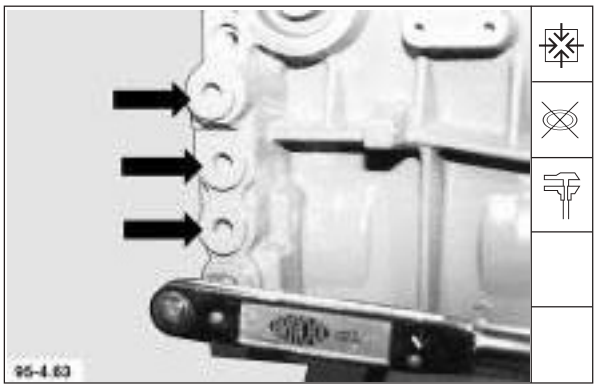
Deutsch



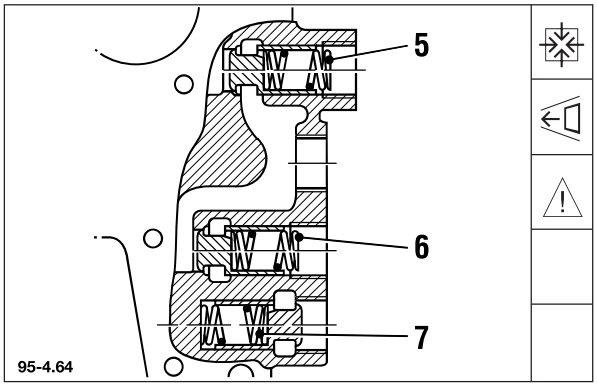
Öldruckventil (ohne Heizungsanschluß)

3. Öldruckventil mit Druckfeder (3 bar, grüne Farbmarkierung) einbauen.



4. Verschlußschrauben mit neuen Cu-Dichtringen festdrehen.

   Anziehvorschrift: **111 Nm**

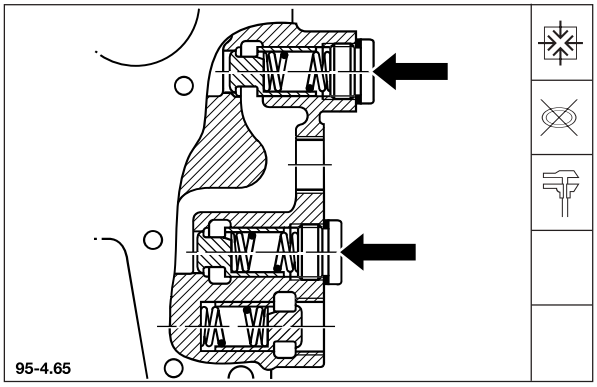


Öldruckventil mit Heizungsanschluß
(falls vorhanden)

5. Öldruckventile mit Druckfedern einbauen.

Hinweis: Auf Einbaurichtung der Ventile und unterschiedliche Druckfedern achten.

Pos. 5 Druckfeder 1,0 bar, gelbe Farbmarkierung
Pos. 6 Druckfeder 1,7 bar, rote Farbmarkierung
Pos. 7 Druckfeder 0,3 bar, blaue Farbmarkierung



6. Verschlußschrauben mit neuen Cu-Dichtungen festdrehen.

   Anziehvorschrift: **111 Nm**

English

Oil pressure control valve
(without heater connection)

3. Fit oil pressure control valve with compression spring (3 bar, green colour marking).

4. Tighten screw plugs with new Cu seals.

   Tightening specification: **111 Nm**

Oil pressure control valve with heater connection
(if any)

5. Fit oil pressure control valves with compression springs.

Note: Watch direction of installation of valves and different compression springs.

Item 5, compr. spring 1.0 bar, yellow colour marking
Item 6, compr. spring 1.7 bar, red colour marking
Item 7, compr. spring 0.3 bar, blue colour marking

6. Tighten screw plugs with new Cu seals.

   Tightening specification: **111 Nm**

Français

Soupape de régulation de pression d'huile
(sans racord pour chauffage)

3. Monter la soupape de régulation de pression d'huile avec le ressort de pression (3 bars, repérage vert).

4. Insérer vis filetées avec un joint au Cu neuf.

   Consigne de serrage: **111 Nm**

Soupape de régulation de pression d'huile avec raccord de chauffage
(si le moteur en est équipé d'un)

5. Monter les soupapes de régulation de pression avec les ressorts de pression.

Nota: veiller au sens de montage des soupapes et aux différents ressorts de pression.

rep. 5 ressort de pression 1,0 bar, repérage jaune
rep. 6 ressort de pression 1,7 bar, repérage rouge
rep. 7 ressort de pression 0,3 bar, repérage bleu

6. Monter vis filetées avec des joints en Cu neufs.

   Consigne de serrage: **111 Nm**

Español

Válvula de presión de aceite
(sin empalme de calefacción)

3. Instalar la válvula de presión de aceite con muelle de presión (3 bar, marcación de color verde).

4. Apretar los tapones provistos de juntas de cobre nuevas.

   Prescripción de apriete: **111 Nm**

Válvula de presión de aceite con empalme de calefacción
(si existe)

5. Instalar las válvulas de presión de aceite con los muelles de presión.

Nota: Observar la dirección en que se monten las válvulas y tener en cuenta los diferentes tipos de muelles.

No. 5 muelle 1,0 bar, marca de color amarillo
No. 6 muelle 1,7 bar, marca de color rojo
No. 7 muelle 0,3 bar, marca de color azul

6. Apretar los tapones provistos de una junta de cobre nueva.

   Prescripción de apriete: **111 Nm**

English

7. Fit O-seals in such a manner to swadged nipples that the spot facing points towards the crankcase.
   Tighten swadged nipple, item 1, and swadged nipple with valve seat, item 2.

   Tightening specification **111 Nm ± 11 Nm**

8. Tighten screw plugs with new Cu seals.

   Tightening specification **50 Nm**

9. Tighten screw plug with new Cu seal.

   Tightening specification **50 Nm**

9.1 Tighten oil pressure switch.

   Tightening specification **13 ± 1.5 Nm**

Français

7. Monter des bagues d'étanchéité neuves sur les embouts de réduction de manière à ce que le lamage soit dirigé vers le vilebrequin.
   Bloquer embout de réduction (1) et embout de réduction avec logement de soupape (2).

   Consigne de serrage: **111 ± 11 Nm**

8. Serrer vis filetée avec joints d'étanchéité neufs en Cu.

   Consigne de serrage: **50 Nm**

9. Serrer vis filetée avec joints d'étanchéité neufs en Cu.

   Consigne de serrage: **50 Nm**

9.1 Bloquer interrupteur de pression d'huile.

   Consigne de serrage: **13 ± 1,5 Nm**

Español

7. Colocar juntas anulares nuevas sobre las boquillas de empalme, de modo que el rebaje indique hacia el bloque motor.
   Apretar la boquilla de empalme 1 y la boquilla de empalme con asiento de válvula 2.

   Prescripción de apriete: **111 ± 11 Nm**

8. Apretar los tapones provistos de una junta anular nueva de cobre.

   Prescripción de apriete: **50 Nm**

9. Apretar el tapón provisto de una junta anular nueva de cobre.

   Prescripción de apriete: **50 Nm**

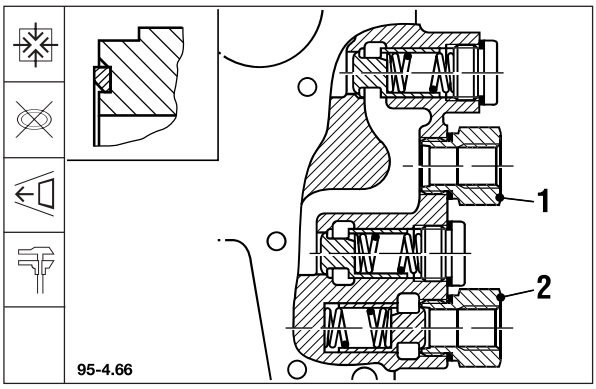
9.1 Apretar el interruptor de presión de aceite.

   Prescripción de apriete: **13 ± 1,5 Nm**

Deutsch

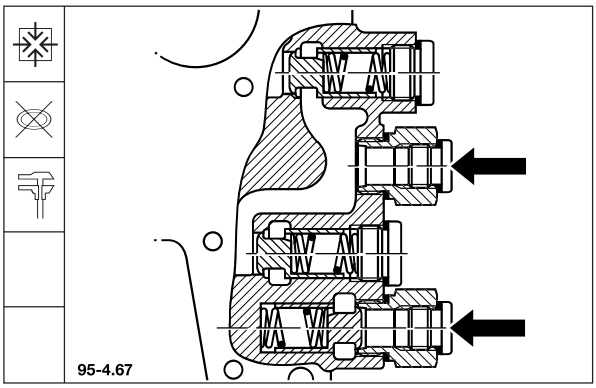
7. Neue Dichtringe so auf die Übergangsnippel montieren, daß die Ansenkung zum Kurbelgehäuse weist.
   Übergangsnippel Pos. 1 und Übergangsnippel mit Ventilsitz Pos. 2 festdrehen.

   Anziehvorschrift: **111 ± 11 Nm**



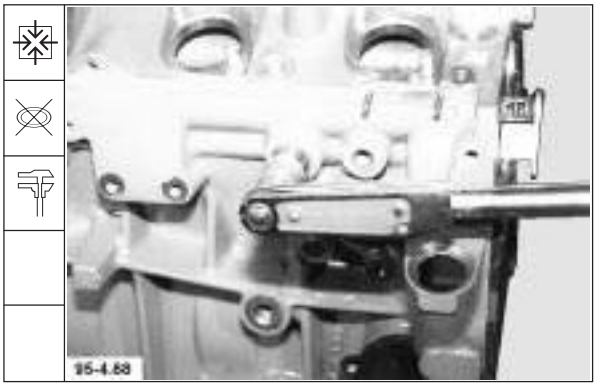
8. Verschlußschrauben mit neuen Cu-Dichtringen festdrehen.

   Anziehvorschrift: **50 Nm**



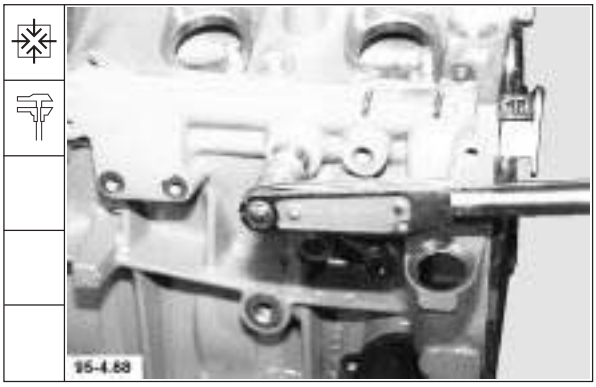
9. Verschlußschraube mit neuem Cu-Dichtring festdrehen.

   Anziehvorschrift: **50 Nm**



9.1 Öldruckschalter festdrehen.

   Anziehvorschrift: **13 ± 1,5 Nm**



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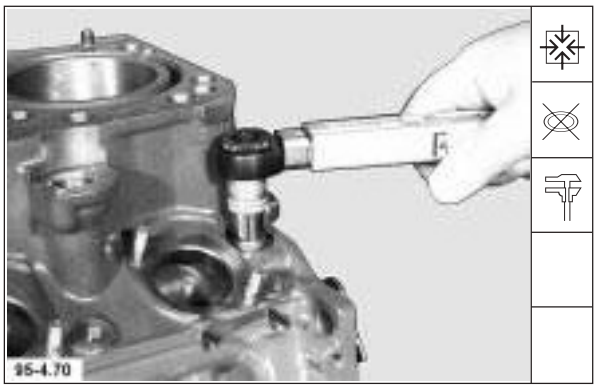
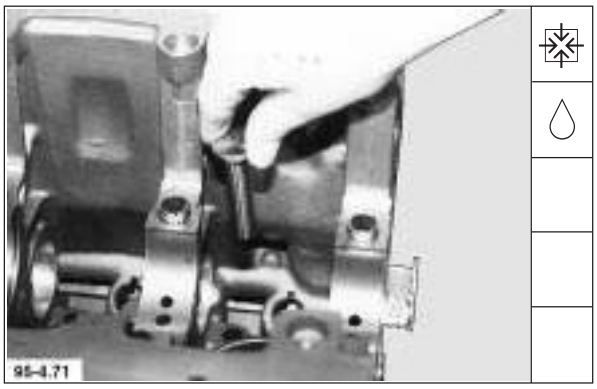
Deutsch



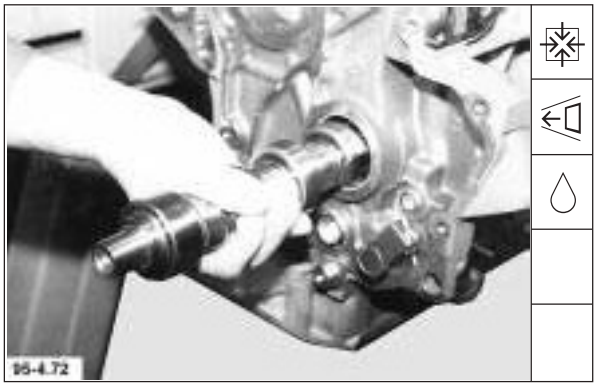
10. Verschlußschraube mit neuem Cu-Dichtring festdrehen.

    Anziehvorschrift: **28 Nm**



Stößel/Nockenwelle

11. Stößel einsetzen.



12. Nockenwelle einsetzen.

13. Anlaufscheibe montieren.

Hinweis: Schmiernut der Anlaufscheibe muß zum Kurbelgehäuse weisen.

English

10. Tighten screw plug with new Cu seal.

    Tightening specification: **28 Nm**

Tappets/camshaft

11. Insert tappets.

12. Introduce camshaft.

13. Fit thrust washer.

Note: Lubricating groove of thrust washer must face crankcase.

Français

10. Serrer vis filetée avec joint d'étanchéité neufs en Cu.

    Consigne de serrage: **28 Nm**

Poussoir/arbre à cames

11. Mettre en place le poussoir.

12. Mettre en place l'arbre à cames.

13. Monter la rondelle de butée.

Nota: la rainure de graissage de la bague de butée doit être orientée vers le bloc moteur.

Español

10. Apretar el tapón con una junta anular nueva de cobre.

    Prescripción de apriete: **28 Nm**

Empujadores/árbol de levas

11. Introducir los empujadores.

12. Introducir el árbol de levas.

13. Montar la arandela de tope.

Nota: La ranura de lubricación de la arandela de tope debe indicar hacia el cárter del motor.

English

14. Screw in adjusting pin for camshaft. Tighten bolt.

    Tightening specification: **21 Nm**

Note: Unscrew adjusting pin again.

Crankshaft bearings

15. Insert bearing shells.

16. Insert bearing shells in main bearing cap.

17. Fit thrust washers to thrust bearing cap and gauge width.

Français

14. Visser la pige de réglage de l'arbre à cames puis bloquer la vis.

    Consigne de serrage: **21 Nm**

Nota: dévisser et extraire la pige de réglage.

Paliers de vilebrequin

15. Mettre en place les coussinets.

16. Mettre an place les coussinets dans le chapeau du palier principal.

17. Appliquer les demi-flasques de butée sur le couvercle du palier d'ajustage et relever la largeur.

Español

14. Enroscar el perno de ajuste del árbol de levas. Apretar el tornillo.

    Prescripción de apriete: **21 Nm**

Nota: Desenroscar el perno de ajuste.

Apoyos del cigüeñal

15. Colocar los semicojinetes.

16. Colocar los semicojinetes en las tapas de los cojinetes de apoyo.

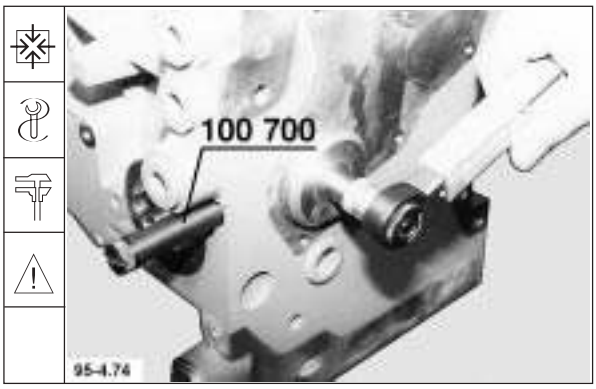
17. Colocar las medias arandelas de tope contra la tapa del cojinete de empuje y medir el ancho.

Deutsch

14. Einstellbolzen für Nockenwelle einschrauben. Schraube festdrehen.

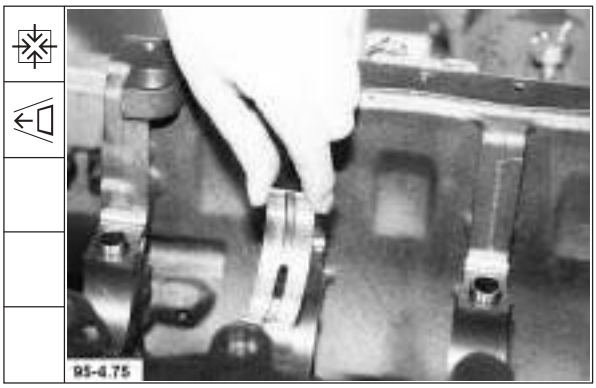
    Anziehvorschrift: **21 Nm**

Hinweis: Einstellbolzen wieder herausschrauben.



Kurbelwellenlagerung

15. Lagerschalen einsetzen.



16. Lagerschalen in Hauptlagerdeckel einsetzen.

17. Anlaufscheiben am Paßlagerdeckel anlegen und Breite messen.

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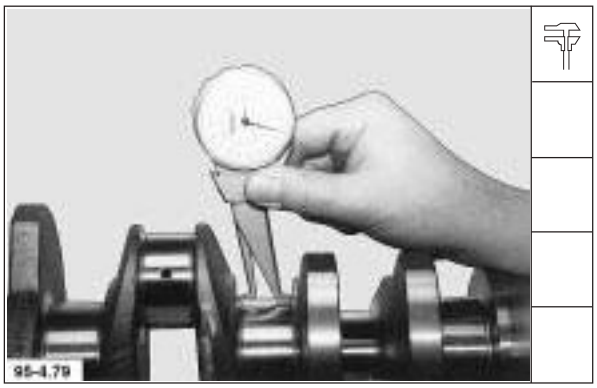
Deutsch

18. Innenmeßgerät auf 35 mm einstellen.



19. Paßlagerzapfenbreite der Kurbelwelle messen.

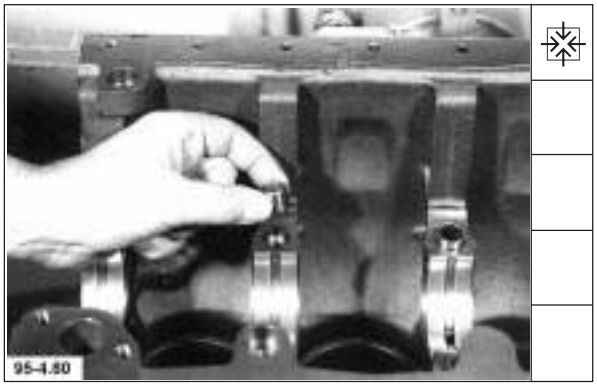
    Axialspiel ermitteln.

    Zapfenbreite normal: **35 + 0,04 mm**
    Grenzmaß für Übermaßstufe: **35,44 mm**

Axialspiel:

Normal: **0,1 - 0,273 mm**
Verschleißgrenze: **0,4 mm**

Hinweis: Bei Bedarf neue Anlaufscheiben zuordnen.



20. Paßhülsen einsetzen.

English

18. Set internal dial gauge to **35 mm**.

19. Gauge thrust bearing journal width of crankshaft.

Determine axial play.

Journal width standard:	**35 + 0.04 mm**
Limit for oversize:	**35.44 mm**

Axial play:

standard:	**0.1 - 0.273 mm**
wear limit:	**0.4 mm**

Note: Use new thrust washers if necessary.

20. Insert locating sleeves.

Français

18. Régler l'appareil de mesure d'intérieur sur une valeur de **35 mm**.

19. Relever la largeur des tourillons du palier d'ajustage du vilebrequin.

Mesurer le jeu axial.

Largeur normale du tourillon:	**35 + 0,04 mm**
Cote limite de réparation	**35,44 mm**

Jeu axial:	**0,1 - 0,273 mm**
Limite d'usure:	**0,4 mm**

Nota: au besoin placer des flasques de butée neuves.

20. Mettre en place les douilles d'ajustage.

Español

18. Ajustar el micrómetro de interiores a **35 mm**.

19. Medir el ancho de muñón para el cojinete de empuje del cigüeñal.

Determinar el juego axial.

Ancho de muñón normal:	**35 + 0,04 mm**
Límite de sobremedida:	**35,44 mm**

Juego axial:

Normal:	**0,1 - 0,273 mm**
Límite de desgaste:	**0,4 mm**

Nota: De ser necesario, colocar otras arandelas nuevas.

20. Meter los casquillos de ajuste.

English	Français	Español
21. Introduce crankshaft.	21. Monter le vilebrequin.	21. Colocar el cigüeñal.
22. Stick half thrust washers with lug to thrust bearing cap using some grease. **Note:** Running layer of thrust washers must face crankweb.	22. Avec un peu de graisse coller sur le chapeau de palier d'ajustage les flasques de butée avec le taquet de guidage. **Nota:** les flasques de butée avec leur face de roulement doivent être orientées vers la joue du vilebrequin.	22. Pegar con un poco de grasa contra la tapa del cojinete de empuje las medias arandelas de tope con talón de guía. **Nota:** Las arandelas de tope deben indicar con su capa de roce hacia la cara lateral de la manivela del cigüeñal.
23. Mount thrust bearing cap. **Note:** Bearing cap No. 1 at flywheel end. Chamfer must point towards flywheel end.	23. Monter le chapeau du palier d'ajustage. **Nota:** le chapeau de palier no. 1 est du côté du volant moteur. La partie chanfreinée en revanche doit être orientée dans le sens inverse au volant moteur.	23. Montar la tapa del cojinete de empuje. **Nota:** La tapa de cojinete No. 1 está en el lado del volante. El bisel debe indicar hacia el lado opuesto al del volante.
24. Mount bearing caps, paying attention to the numbering.	24. Monter le chapeau de palier principal en respectant la numérotation.	24. Montar las tapas de los cojinetes de apoyo según la numeración.

Deutsch

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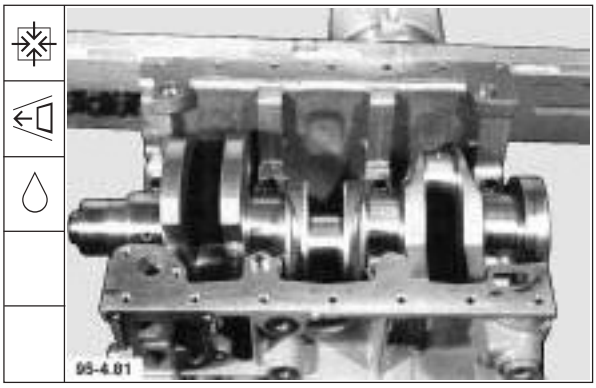
21. Kurbelwelle einsetzen.

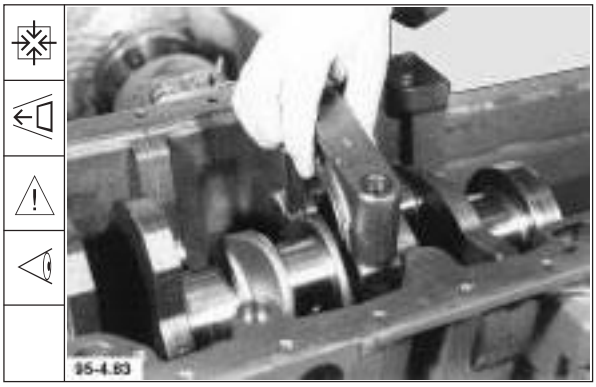


22. Anlaufscheiben mit Führungsnase am Paßlagerdeckel mit etwas Fett ankleben.

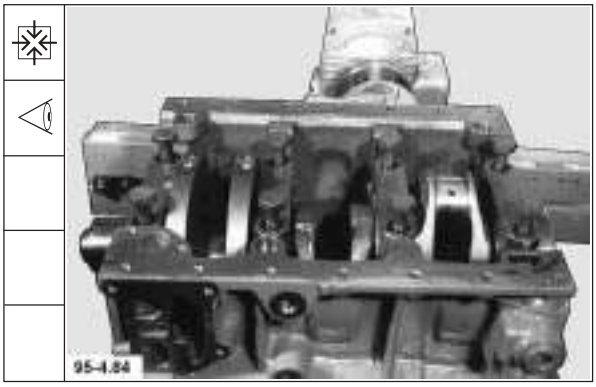
Hinweis: Anlaufscheiben müssen mit der Laufschichtseite zum Wangenspiegel der Kurbelwelle weisen.

23. Paßlagerdeckel aufbauen.

Hinweis: Lagerdeckel Nr. 1 ist schwungradseitig. Anschrägung muß entgegen der Schwungradseite weisen.



24. Hauptlagerdeckel entsprechend der Numerierung montieren.



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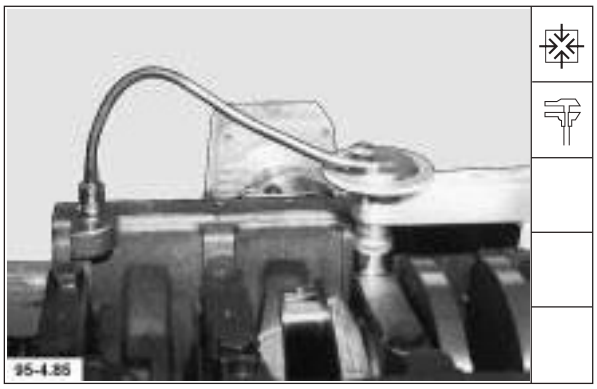
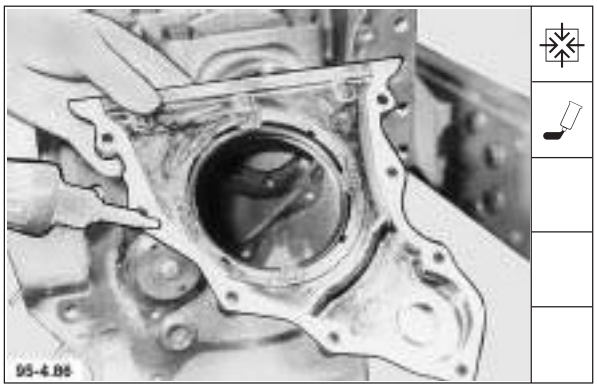
Deutsch



25. Hauptlagerschrauben festdrehen.

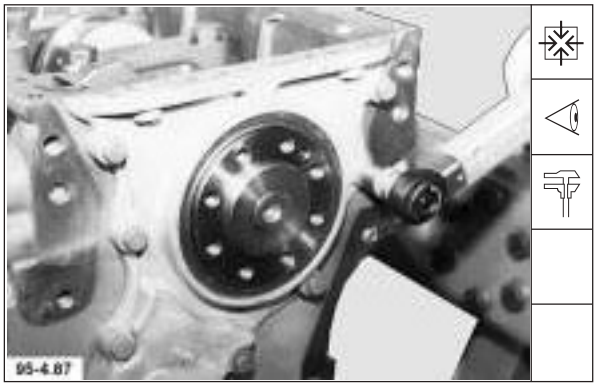
    Anziehvorschrift:

Vorspannwert	**50 Nm**
1. Nachspannwinkel	**60°**
2. Nachspannwinkel	**45°**



Hinterer Deckel

26. Hinteren Deckel mit DEUTZ **DW 67** bestreichen.



27. Deckel komplett mit Wellendichtring anbauen. Deckel zur Ölwannendichtfläche ausrichten. Schrauben festdrehen .

    Anziehvorschrift: **21 Nm**

Abstand Hubzapfenoberkante OT bis Zylinderkopfdichtfläche messen.
(Nur FL- und FM - Motoren)

28. Abstand Hubzapfenoberkante OT bis Zylinderkopfdichtfläche an jedem Zylinder messen.

English

25. Tighten main bearing bolts.

    Tightening specification:

Initial tightening torque	**50 Nm**
1st tightening angle	**60°**
2nd tightening angle	**45°**

Rear cover

26. Apply sealing compound DEUTZ **DW 67** to rear cover.

27. Fit cover complete with shaft seal. Align cover relative to oil pan sealing surface. Tighten bolts.

    Tightening specification: **21 Nm**

Gauge distance between top edge of crankpin in TDC and cylinder head sealing surface. (Only FL and FM engines)

28. Gauge on every cylinder distance between top edge of crankpin in TDC and cylinder head sealing surface.

Français

25. Bloquer les vis des paliers principaux.

    Consigne de serrage:

Valeur de préserrage	**50 Nm**
1er serrage à l'angle	**60°**
2e serrage à l'angle	**45°**

Couvercle arrière

26. Enduire le couvercle arrière de pâte d'étanchéité DEUTZ **DW 67.**

27. Monter le couvercle complet avec le joint d'arbre. Aligner le couvercle par rapport à la surface d'étanchéité du carter d'huile. Bloquer les vis.

    Consigne de serrage: **21 Nm**

Mesurer espace entre arête supérieure du maneton au PMH et plan de joint de la culasse (uniquement pour moteurs FL et FM).

28. Mesurer à chaque cylindre espace entre arête supérieure du maneton au PMH et plan de joint de la culasse.

Español

25. Apretar los tornillos de los cojinetes de apoyo.

    Prescripción de apriete:

Apriete inicial	**50 Nm**
1er ángulo de reapriete	**60°**
2o ángulo de reapriete	**45°**

Tapa trasera

26. Aplicar DEUTZ **DW 67** a la tapa trasera.

27. Montar la tapa completa con retén. Alinear la tapa con respecto a la superficie de cierre del cárter de aceite. Apretar los tornillos.

    Prescripción de apriete: **21 Nm**

Medición de la distancia entre el canto superior de la muñequilla a PMS y la superficie de asiento de la junta de culata. (Sólo motores FL y FM)

28. Medir en cada cilindro la distancia que media entre el canto superior de la muñequilla a PMS y la superficie de asiento de la junta de culata.

English

28.1

FL 1011 F

specified dimension x	Piston class
x1 = **199.890 - 199.99**	A
x2 = **199.991 - 200.09**	B
x3 = **200.091 - 200.19**	C

FM 1011 F

specified dimension x	Piston class
x1 = **196.390 - 196.49**	A
x2 = **196.491 - 196.59**	B
x3 = **196.591 - 196.59**	C

28.2 Compare actual dimension with the specified dimensions in the table. Select piston class per cylinder. See Chapter. 3.

Note: In the case of crankshaft undersizes, **0.125 mm** must be added to the dimension indicated in the table.

29. Insert bearing shells into connecting rod.

30. Piston ring gaps must be staggered.

Français

28.1

FL 1011 F

Valeur prescrite x	Catégorie de piston
x1 = **199,890 - 199,99**	A
x1 = **199,991 - 200,09**	B
x3 = **200,091 - 200,19**	C

FM 1011 F

Valeur prescrite x	Catégorie de piston
x1 = **196,390 - 196,49**	A
x1 = **196,491 - 196,59**	B
x3 = **196,591 - 196,69**	C

28.2 Comparer les valeurs réelles avec les valeurs de consigne figurant sur le tableau. Choisir la catégorie du piston en fonction du cylindre. Voir Chap. 3.

Nota: en cas de cotes de réparation vilebrequin sous-dimensionnées ajouter aux valeurs figurant sur le tableau à chaque fois **0,125 mm.**

29. Monter les coussinets dans la bielle.

30. Tiercer les coupes de segments.

Español

28.1

FL 1011 F:

Medida teórica x	Clase de pistón
x1 = **199,890 - 199,99**	A
x1 = **199,991 - 200,09**	B
x3 = **200,091 - 200,19**	C

FM 1011 F:

Medida teórica x	Clase de pistón
x1 = **196,390 - 196,49**	A
x1 = **196,491 - 196,59**	B
x3 = **196,591 - 196,69**	C

28.2 Comparar la medida real con la teórica especificada en la tabla. Elegir la clase de pistón de cada cilindro. Ver cap. 3.

Nota: En caso de inframedidas del cigüeñal han de añadirse **0,125 mm** a la respectiva medida indicada en la tabla.

29. Montar los semicojinetes en la biela.

30. Desplazar entre sí los cortes de los aros de pistón.

Deutsch

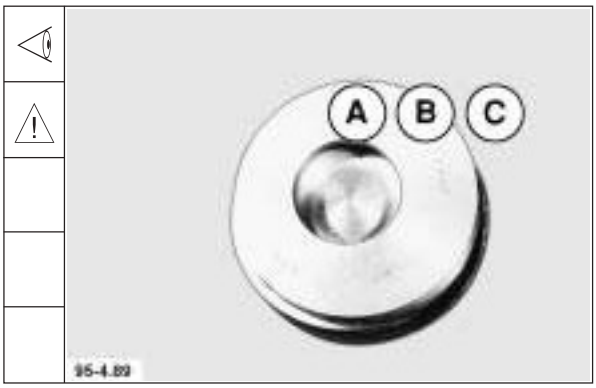
28.1

FL 1011 F Sollmaß x	Kolbenklasse
x1 = **199,890 - 199,99**	A
x2 = **199,991 - 200,09**	B
x3 = **200,091 - 200,19**	C

FM 1011 F Sollmaß x	Kolbenklasse
x1 = **196,390 - 196,49**	A
x2 = **196,491 - 196,59**	B
x3 = **196,591 - 196,69**	C

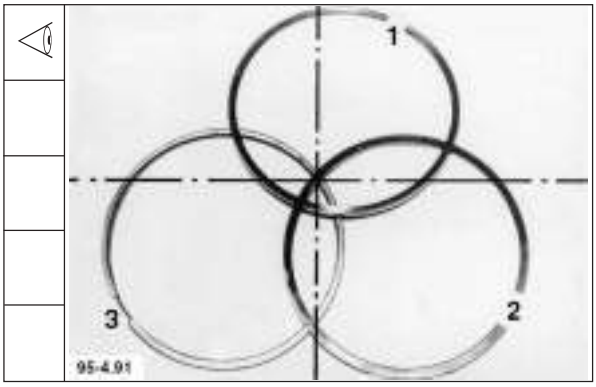
28.2 Istmaß mit den in der Tabelle aufgeführten Sollmaßen vergleichen. Kolbenklasse je Zylinder auswählen. Siehe Kap. 3.

Hinweis: Bei Untermaßstufen der Kurbelwelle sind zu den in der Tabelle aufgeführten Maßen jeweils **0,125 mm** hinzuzuzählen.



29. Pleuellagerschalen in Pleuelstange einbauen.

30. Kolbenringstöße zueinander versetzt anordnen.



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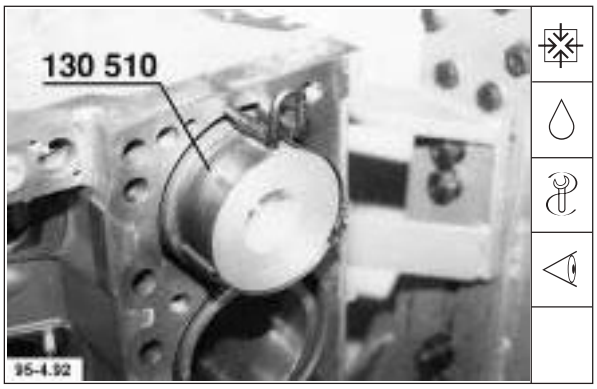
Deutsch



31. Kolben komplett mit Pleuel in das Zylinderkurbelgehäuse einschieben.

Hinweis: Schwungradsymbol auf dem Kolben muß zum Schwungrad weisen.

32. Pleuelstange gegen den Hubzapfen drücken. Dazugehörigen Pleuellagerdeckel montieren.

Hinweis: Pleuelschrauben können bei Nachweisbarkeit max. **5 mal** wiederverwendet werden.

33. Pleuelmuttern mit **12 kant-Steckschlüssel** festdrehen.

Anziehvorschrift:

Vorspannwert	**30 Nm**
1. Nachspannwinkel	**60°**
2. Nachspannwinkel	**60°**

34. Pleuelstangen kontrollieren, ob sie sich auf dem Hubzapfen leicht verschieben lassen.

English

31. Introduce piston complete with connecting rod into crankcase with integrated cylinders.

Note: Flywheel symbol must point towards flywheel.

32. Press connecting rod against crankpin. Fit pertinent big end bearing cap.

Note: Conrod bolts may be used max. **5 x** if evidence can be provided concerning their use.

33. Tighten conrod nuts with **dodecagonal socket wrench**.

Tightening specification:

Intitial tightening torque	**30 Nm**
1st tightening angle	**60°**
2nd tightening angle	**60°**

34. Check that connecting rods can be easily moved back and forth on the crankpin.

Français

31. Introduire l'ensemble piston-bielle complet dans le bloc moteur.

Nota: le symbole figurant sur le volant moteur doit être orienté vers le volant.

32. Enfoncer la bielle sur le maneton en montant le chapeau de bielle correspondant. Monter les chapeaux de palier de bielle correspondants.

Nota: ne pas utiliser les boulons de bielle plus de **5 fois.**

33. Serrer les écrous de bielle avec **une clé à douille à 12 pans** selon les préconisations de serrage.

Consigne de serrage:

Valeur de préserrage	**30 Nm**
1er serrage à l'angle	**60°**
2e serrage à l'angle	**60°**

34. Contrôler si les bielles glissent facilement sur les manetons.

Español

31. Introducir el pistón completo con la biela en el bloque de cilindros.

Nota: El símbolo del volante en el pistón debe indicar hacia el volante.

32. Presionando la biela contra la muñequilla, montar la tapa de biela correspondiente.

Nota: Los pernos de biela pueden ser reutilizados hasta **5 veces** si esto es comprobable.

33. Apretar las tuercas de biela utilizando una **llave de vaso de 12 cantos**.

Prescripción de apriete:

Apriete inicial	**30 Nm**
1er ángulo de reapriete	**60°**
2o ángulo de reapriete	**60°**

34. Controlar si las bielas pueden moverse fácilmente sobre la muñequilla.

English

Front cover

35. Apply sealing compound DEUTZ **DW 67** to front cover sealing surface.

Note: Camshaft/centrifugal governor connection must be clean and free of oil.

36. Fit front cover together with shaft seals and align relative to oil pan sealing surface.

Note: When fitting cover pay attention to crankshaft seal.

37. Tighten bolts.

    Tightening specification: **21 Nm**

Crankshaft toothed belt gear

38. Slide on crankshaft toothed belt gear.

Note: All connecting surfaces must be clean and free of oil.

Français

Couvercle avant

35. Enduire la surface d'étanchéité du couvercle avant de pâte d'étanchéité DEUTZ **DW 67.**

Nota: la liaison entre l'arbre à cames et le régulateur centrifuge doit être parfaitement propre et exempte d'huile.

36. Monter le couvercle avant complet avec les joints d'arbre et l'ajuster par rapport à la surface d'étanchéité du carter d'huile.

Nota: au montage veiller au joint d'étanchéité du vilebrequin.

37. Bloquer les vis.

    Consigne de serrage: **21 Nm**

Pignon de courroie crantée du vilebrequin

38. Introduire le pignon de courroie crantée du vilebrequin.

Nota: toutes les surfaces de liaison doivent être parfaitement propres et exemptes d'huile.

Español

Tapa delantera

35. Aplicar sellante DEUTZ **DW 67** a la superficie de cierre de la tapa delantera.

Nota: La unión entre árbol de levas y regulador centrífugo debe estar limpia y exenta de aceite.

36. Montar la tapa delantera completa con los retenes y alinearla con respecto a la superficie de cierre del cárter de aceite.

Nota: Al montar, prestar atención al retén para el cigüeñal.

37. Apretar los tornillos.

    Prescripción de apriete: **21 Nm**

Rueda de correa dentada en el cigüeñal

38. Colocar la rueda de correa dentada en el cigüeñal.

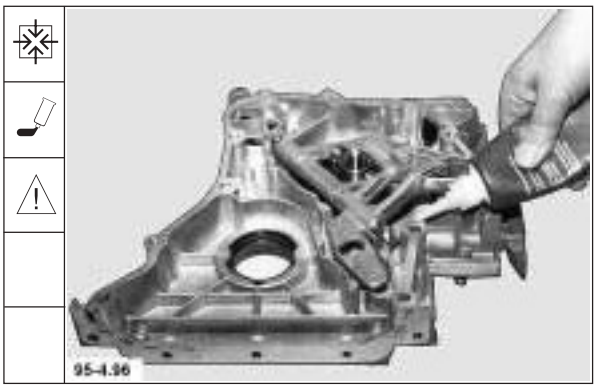
Nota: Todas las superficies de unión deben estar limpias y exentas de aceite.

Deutsch

Vorderer Deckel

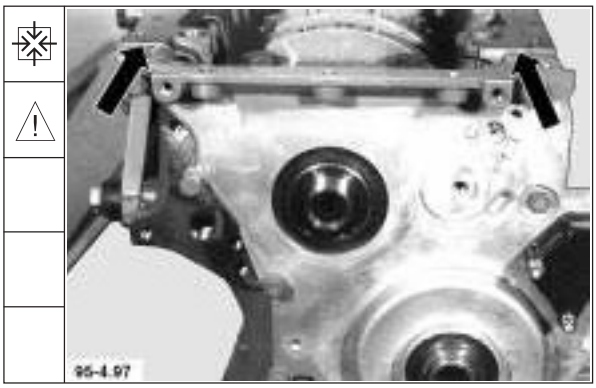
35. Dichtfläche des vorderen Deckels mit Dichtmittel DEUTZ **DW 67** bestreichen.

Hinweis: Verbindung zwischen Nockenwelle und Fliehkraftregler muß sauber und ölfrei sein.



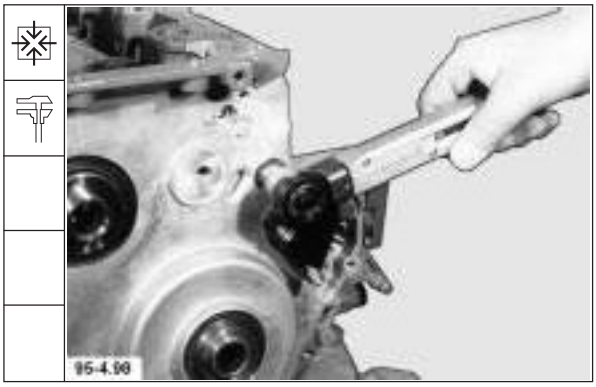
36. Vorderen Deckel komplett mit Wellendichtringe montieren und zur Ölwannendichtfläche ausrichten.

Hinweis: Bei Montage auf Kurbelwellendichtring achten.



37. Schrauben festdrehen.

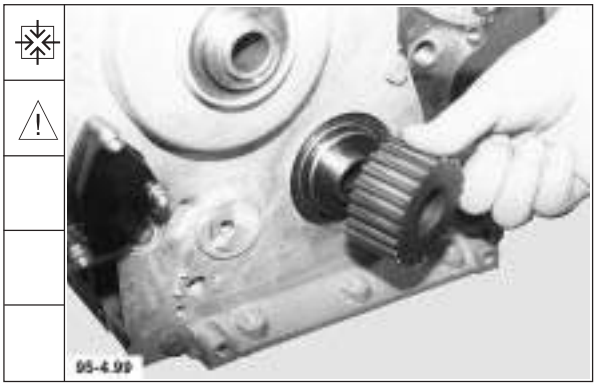
Anziehvorschrift: **21 Nm**



Kurbelwellenzahnriemenrad

38. Kurbelwellenzahnriemenrad aufschieben.

Hinweis: Alle Verbindungsflächen müssen sauber und ölfrei sein.



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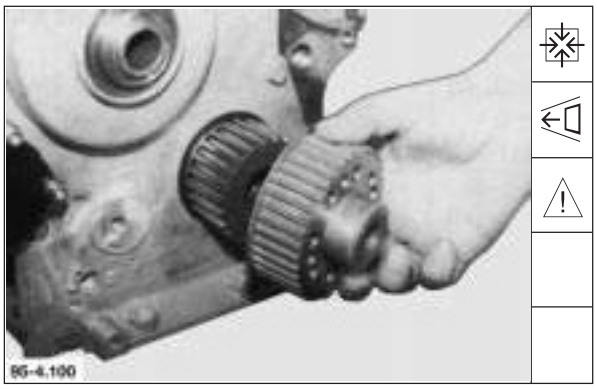
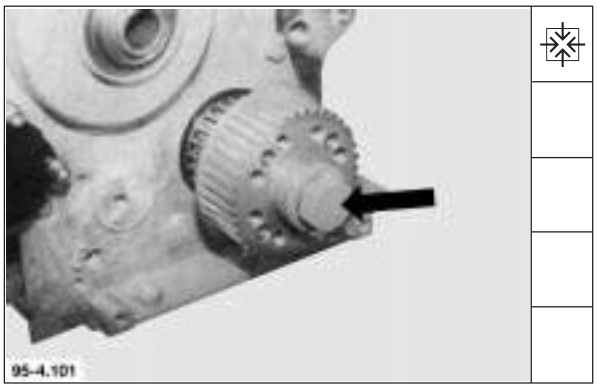
Deutsch

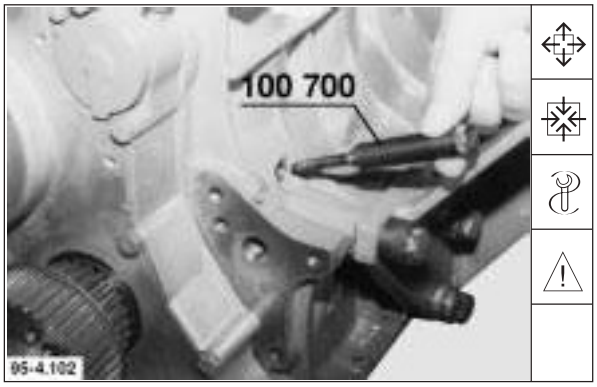


39. Falls vorhanden, Kurbelwellenzahnriemenrad für Hydraulikpumpe in die Zentrierung einsetzen.

Hinweis: Ohne Hydraulikpumpenanbau wird an Stelle des Zahnrades ein Zwischenstück verwendet.



40. Zentralschraube leicht andrehen.



41. Verschlußschraube herausschrauben. Einstellbolzen für Kurbelwelle bis Anlage einschrauben. Kurbelwelle im Uhrzeigersinn gegen den Anschlag drehen.

Hinweis: Kolben am vorderen Deckel ist in OT.

42. Zentralschraube vorspannen.

Anziehvorschrift: **130 Nm**

English

39. Insert crankshaft toothed belt gear for hydraulic pump, if any, in centering.

Note: If no hydraulic pump is mounted, a spacer is used instead of the gear.

40. Start central bolt.

41. Undo screw plug. Screw in adjusting pin for crankshaft as far as it will go. Turn crankshaft in clockwise direction against stop.

Note: Piston at front cover is in TDC.

42. Initially tighten central bolt.

Tightening specification: **130 Nm**

Français

39. Si le moteur en est équipé d'un, placer sur le centrage le pignon de la courroie dentée du vilebrequin de la pompe hydraulique

Nota: sans montage de pompe hydraulique utiliser en lieu et place du pignon une pièce intermédiaire.

40. Serrer légèrement la vis centrale.

41. Dévisser la vis filetée. Visser la pige de calage du vilebrequin jusqu'en butée. Virer le vilebrequin dans le sens horaire jusqu'en position de butée.

Nota: le piston se trouvant près du chapeau avant est au PMH.

42. Préserrer la vis centrale.

Consigne de serrage: **130 Nm**

Español

39. Si existe, introducir en el centraje la rueda de correa dentada del cigüeñal para la bomba hidráulica.

Nota: Si no se monta la bomba hidráulica, se coloca una pieza intermedia en lugar de la rueda dentada.

40. Apretar ligeramente el tornillo central.

41. Desenroscar el tapón. Enroscar el perno de ajuste del cigüeñal hasta que se asiente. Girar el cigüeñal en el sentido de las agujas del reloj contra el tope.

Nota: El pistón cerca de la tapa delantera está en el PMS.

42. Apretar el tornillo central con un par previo.

Prescripción de apriete: **130 Nm**

English

43. Position intermediate disc.

Note: Remove adjusting pin for crankshaft.

44. Fit dolly and tighten.

45. Insert multipower tool with socket in dolly.

46. Retain multipower tool and tighten central bolt.

Tightening specification: **210° + 10°**

Français

43. Placer le disque intermédiaire.

Nota: ôter la pige de calage du vilebrequin.

44. Monter et serrer la contre-butée.

45. Insérer le multiplicateur de couple avec la douille dans la contre-butée.

46. Maintenir le multiplicateur de couple et serrer la vis centrale.

Consigne de serrage: **210° + 10°**

Español

43. Colocar la arandela intermedia.

Nota: Retirar el perno de ajuste del cigüeñal.

44. Montar el contrasoporte y apretar.

45. Meter en el contrasoporte el multiplicador de fuerza con la llave de vaso puesta.

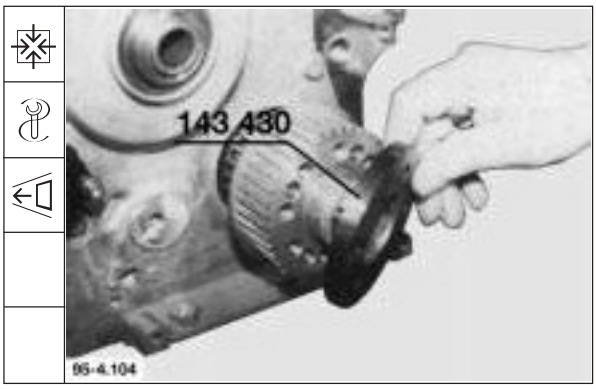
46. Retener el multiplicador de fuerza y apretar definitivamente el tornillo central.

Prescripción de apriete: **210°+10°**

Deutsch

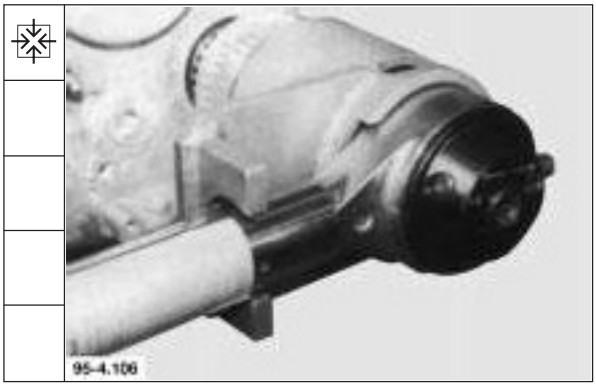
43. Zwischenscheibe aufsetzen.

Hinweis: Einstellbolzen für Kurbelwelle entfernen.



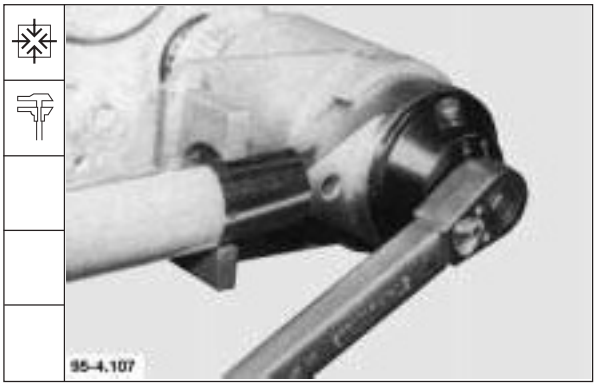
44. Gegenhalter anbauen und festdrehen.

45. Kraftvervielfältiger mit Stecknuß in den Gegenhalter einsetzen.



46. Kraftvervielfältiger gegenhalten und Zentralschraube festdrehen.

Anziehvorschrift: **210° + 10°**



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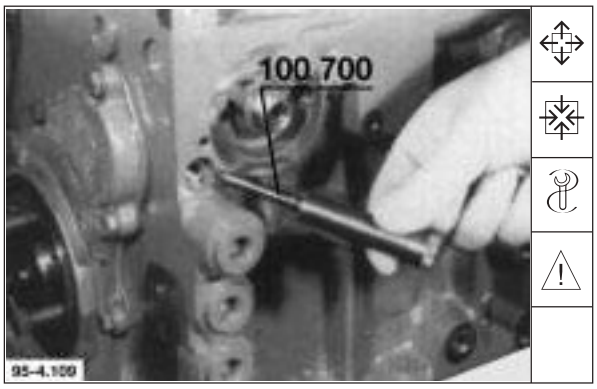
Deutsch

47. Rasterknopf drücken. Kraftvervielfältiger entlasten.
    Kraftvervielfältiger, Gegenhalter und Zwischenscheibe abbauen.

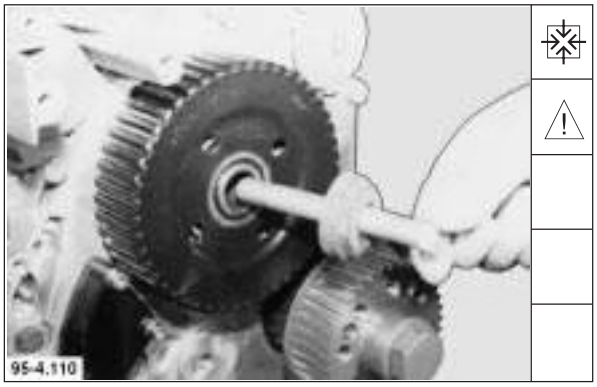
Hinweis: Einstellbolzen für Kurbelwelle wieder bis zur Anlage einschrauben.
Kurbelwelle im Uhrzeigersinn gegen den Anschlag drehen. Kolben am vorderen Deckel ist in O.T.



Nockenwellenzahnriemenrad

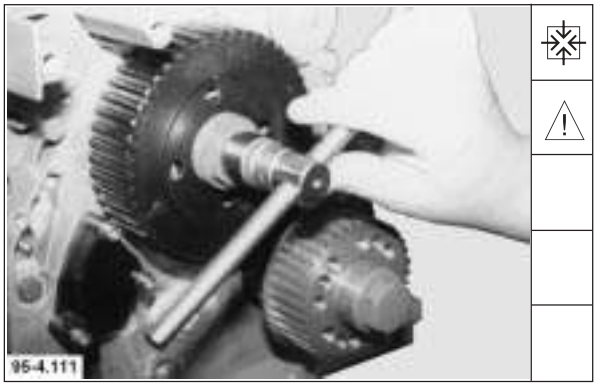
48. Verschlußschraube herausschrauben. Einstellbolzen für Nockenwelle in das Kurbelgehäuse bis zur Anlage einschrauben.

Hinweis: Bohrung der Nockenwelle muß mit der Bohrung im Kurbelgehäuse in Überdeckung stehen.



49. Zahnriemenrad, Scheibe und Schraube aufsetzen.

Hinweis: Alle Verbindungsflächen müssen sauber und ölfrei sein.



50. Nockenwellenzentralschraube handfest andrehen.

Hinweis: Nockenwellenzahnrad muß noch drehbar sein.

English

47. Depress detent knob. Unload multipower tool.
Remove multipower tool, dolly and intermediate disc.

Note: Screw adjusting pin for crankshaft back in again as far as it will go.
Turn crankshaft in clockwise direction against stop. Piston at front cover is in TDC.

Camshaft toothed belt gear

48. Undo screw plug. Screw camshaft adjusting pin into crankcase as far as it will go.

Note: Bore of camshaft must overlap with bore in crankcase.

49. Position toothed belt gear, washer and bolt.

Note: All connecting surfaces must be clean and free of oil.

50. Secure camshaft central bolt fingertight.

Note: Camshaft gear must still turn freely.

Français

47. Enfoncer le bouton à crans et soulager le multiplicateur de couple.
Déposer ensuite le multiplicateur de couple, la contre-butée et le disque intermédiaire.

Nota: visser la pige de réglage de vilebrequin jusqu'en position d'appui.
Virer le vilebrequin dans le sens horaire jusqu'en butée. Le piston du couvercle avant est en position de PMH.

Pignon de courroie crantée d'arbre à cames

48. Dévisser et retirer vis filetée.
Visser la pige de réglage de l'arbre à cames jusqu'en position d'appui.

Nota: l'alésage de l'arbre à cames doit correspondre à celui du bloc moteur.

49. Mettre en place le pignon de courroie crantée, la rondelle et la vis.

Nota: toutes les surfaces de liaison doivent être parfaitement propres et sans huile.

50. Bien serrer à la main la vis centrale de l'arbre à cames.

Nota: le pignon d'arbre à cames doit pouvoir encore tourner.

Español

47. Oprimir el botón reticulado.
Descargar el multiplicador de fuerza.
Desmontar el multiplicador de fuerza, el contrasoporte y la arandela intermedia.

Nota: Enroscar de nuevo el perno de ajuste del cigüeñal hasta que se asiente. Girar el cigüeñal en el sentido de las agujas del reloj contra el tope. El pistón cerca de la tapa delantera está en su PMS.

Rueda de correa dentada del árbol de levas

48. Desenroscar el tapón. Enroscar el perno de ajuste del árbol de levas en el bloque motor hasta que se asiente.

Nota: El orificio del árbol de levas y el existente en el bloque motor deben coincidir.

49. Colocar la rueda de correa dentada, arandela y tornillo.

Nota: Todas las superficies de unión deben estar limpias y exentas de aceite.

50. Apretar a mano el tornillo central del árbol de levas.

Nota: La rueda dentada del árbol de levas debe poderse girar todavía.

English

Lube oil pump

51. Position gasket.

52. Mount oil pump.

Note: Pay attention to dowel sleeves.

53. Tighten bolts.

    Tightening specification: **22 Nm**

Toothed belt adjustment

54. Position new toothed belt.

Note: Hold crankshaft against stop while adjusting toothed belt.

Français

Pompe à huile de graissage

51. Placer un joint.

52. Monter la pompe à huile.

Nota: attention aux douilles d'ajustage.

53. Serrer les vis.

    Consigne de serrage: **22 Nm**

Réglage de la courroie crantée

54. Mettre en place une courroie crantée neuve.

Nota: durant le réglage de la courroie crantée maintenir le vilebrequin en butée.

Español

Bomba de aceite lubricante

51. Colocar la junta.

52. Montar la bomba de aceite lubricante.

Nota: Prestar atensión a los casquillos de sujeción.

53. Apretar los tornillos.

    Prescripción de apriete: **22 Nm**

Ajuste de la correa dentada

54. Colocar una correa dentada nueva.

Nota: Mientras se efectúa el ajuste de la correa dentada, es necesario retener el cigüeñal contra el tope.

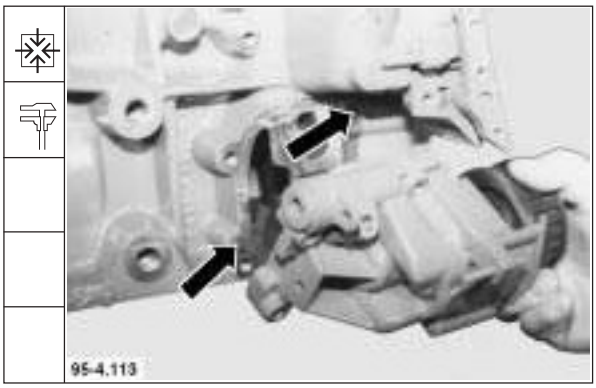
Deutsch

Schmierölpumpe

51. Dichtung auflegen.

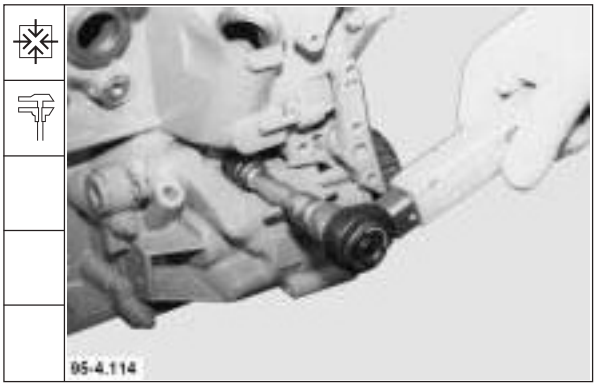
52. Schmierölpumpe anbauen.

Hinweis: Auf Spannhülsen achten.



53. Schrauben festdrehen.

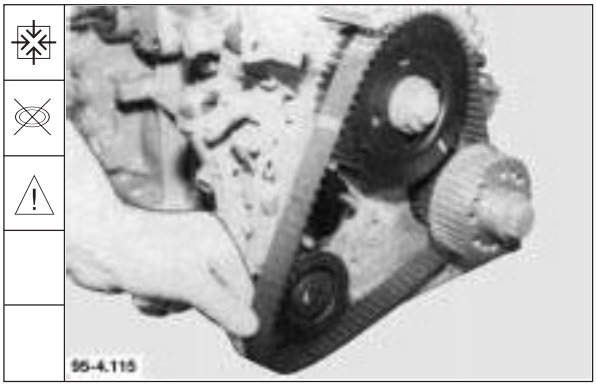
Anziehvorschrift: **22 Nm**



Zahnriemeneinstellung

54. Neuen Zahnriemen auflegen

Hinweis: Während der Zahnriemeneinstellung ist die Kurbelwelle gegen den Anschlag zu halten.



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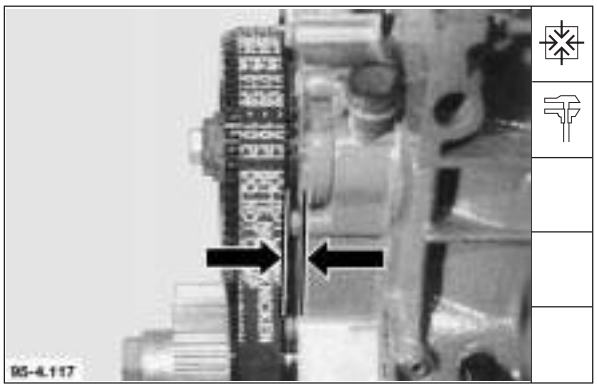
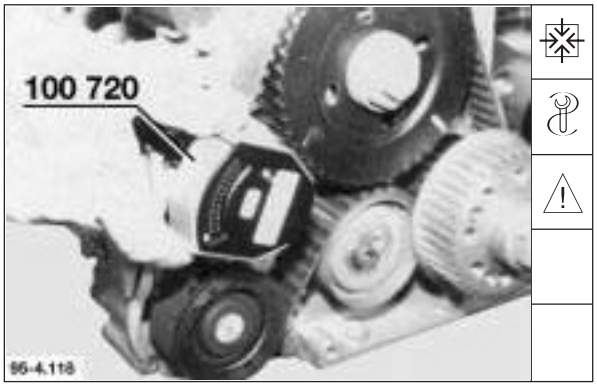
Deutsch

55. Neue Zahnriemenspannrolle anbauen und handfest andrehen. Alle Verbindungsflächen müssen sauber und ölfrei sein. Das Sechskantloch muß zur Ölwannendichtfläche zeigen.

Hinweis: Für Einstellarbeiten ist der Deckel zu entfernen.



56. Zahnriemen so ausrichten, daß ein gleichmäßiger Abstand vom Deckel von **8 bis 9 mm** vorhanden ist.



57. Zahnriemenspannungs-Meßgerät aufsetzen.

Hinweis: Zahnriemenspannungs-Meßgerät darf nur den Zahnriemen berühren.

58. Zahnriemen vorspannen. Spannrolle entgegen dem Uhrzeigersinn drehen, so daß ein Skalenwert von **3,0 - 3,5** erreicht wird. Schraube von Spannrolle festdrehen.

    Anziehvorschrift: **45 Nm**

English

55. Fit new toothed belt idler pulley and secure fingertight. All connecting surfaces must be clean and free of oil. The hexagon bore must point towards oil pan sealing surface.

Note: Remove cover for adjustment work.

56. Align toothed belt so as to ensure an equal distance from cover between **8 and 9 mm.**

57. Position toothed belt tension gauge.

Note: Gauge may only have contact with toothed belt.

58. Initially tighten toothed belt. Turn idler pulley in anti-clockwise direction to obtain a scale reading of **3.0 - 3.5**. Tighten bolt of idler pulley.

Tightening specification: **45 Nm**

Français

55. Monter galet tendeur de courroie crantée neuf et bien serrer à la main. Toutes les surfaces de liaison doivent rester parfaitement propres et sans huile. Le trou hexagonal doit être dirigé vers le plan de joint du carter d'huile.

Nota: pour les travaux de réglage ôter le couvercle.

56. Ajuster la courroie crantée de manière à avoir une distance uniforme par rapport au couvercle de l'ordre de **8 à 9 mm.**

57. Mettre en place l'appareil de mesure de tension de la courroie crantée.

Nota: l'appareil de mesure de tension de la courroie crantée ne doit être en contact qu'avec la courroie crantée.

58. Soumettre la courroie crantée à une précontrainte. Virer le galet tendeur dans le sens antihoraire jusqu'à obtention de **3,0 - 3,5** sur l'échelle de valeurs.
Serrer la vis du galet tendeur.

Consigne de serrage: **45 Nm**

Español

55. Montar una polea tensora nueva para la correa dentada y apretar a mano. Todas las superficies de unión deben estar limpias y exentas de aceite. El hexágono interior debe indicar hacia la superficie de cierre del cárter de aceite.

Nota: Para los trabajos de ajuste hay que quitar la tapa.

56. Alinear la correa dentada, de modo que tenga una distancia uniforme de **8 a 9 mm** a la tapa.

57. Colocar el verificador de tensión para correas dentadas.

Nota: El verificador sólo debe entrar en contacto con la correa dentada.

58. Pretensar la correa dentada. Girar la polea tensora en contra del sentido de las agujas del reloj hasta que se alcance un valor de **3,0 - 3,5** en la escala. Apretar el tornillo de la polea.

Prescripción de apriete: **45 Nm**

English

59. Retain centering washer. Initially tighten camshaft central bolt.

    Tightening specification: **30 Nm**

60. Mark camshaft central bolt and centering washer. Tighten bolt.

    Tightening specification:
    Tightening angle **210°**

61. Take off toothed belt tension gauge. Remove adjusting pins for camshaft and crankshaft.

62. Mark camshaft gear and opposite bolt.

Français

59. Maintenir le disque de centrage et serrer la vis de centrage de l'arbre à cames.

    Consigne de serrage: **30 Nm**

60. Repérer la vis de l'arbre à cames et marquer le disque de centrage. Serrer la vis.

    Consigne de serrage
    à l'angle **210°**

61. Retirer l'appareil de mesure de tension de courroie crantée et ôter la pige de calage de l'arbre à cames et du vilebrequin.

62. Repérer le pignon d'arbre à cames et la vis située en regard.

Español

59. Retener el disco de centraje, apretar el tornillo central del árbol de levas con el par previo prescrito.

    Prescripción de apriete: **30 Nm**

60. Marcar el tornillo central del árbol de levas y el disco de centraje. Apretar el tornillo definitivamente.

    Prescripción de apriete:
    Angulo de reapriete: **210°**

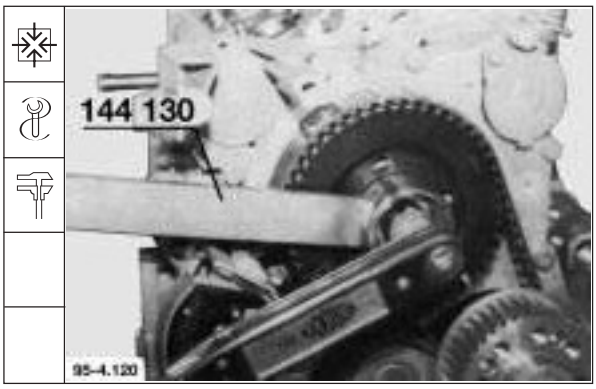
61. Retirar el verificador de tensión. Quitar los pernos de ajuste del árbol de levas y cigüeñal.

62. Marcar la rueda dentada del árbol de levas y el tornillo opuesto.

Deutsch

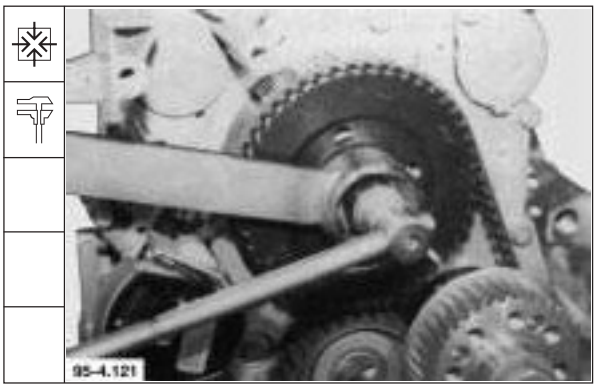
59. Zentrierscheibe gegenhalten, Nockenwellenzentralschraube vorspannen.

    Anziehvorschrift: **30 Nm**

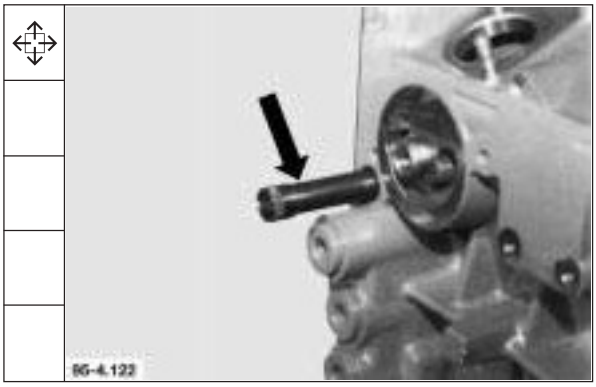


60. Nockenwellenzentralschraube und Zentrierscheibe kennzeichnen. Schraube festdrehen.

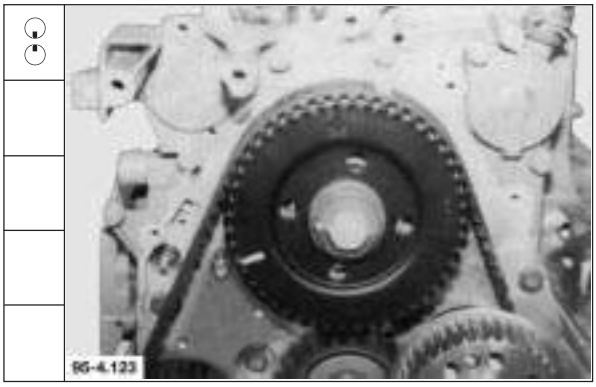
    Anziehvorschrift:
    Nachspannwinkel **210**°



61. Zahnriemenspannungs-Meßgerät abnehmen. Einstellbolzen für Nocken- und Kurbelwelle entfernen.



62. Nockenwellenzahnrad und gegenüberliegende Schraube markieren.



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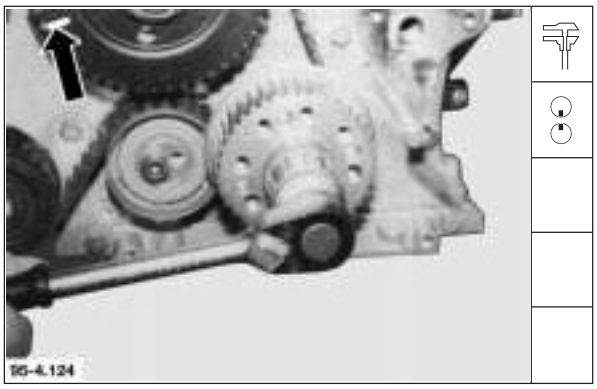
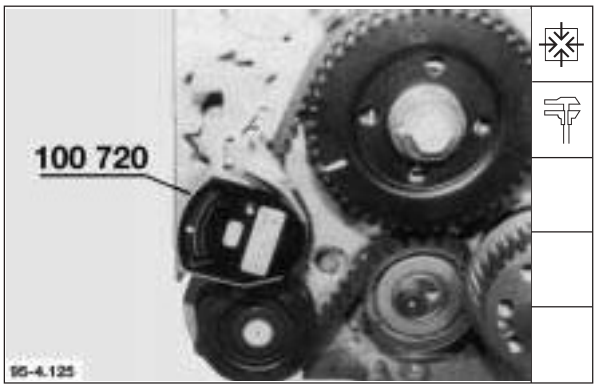
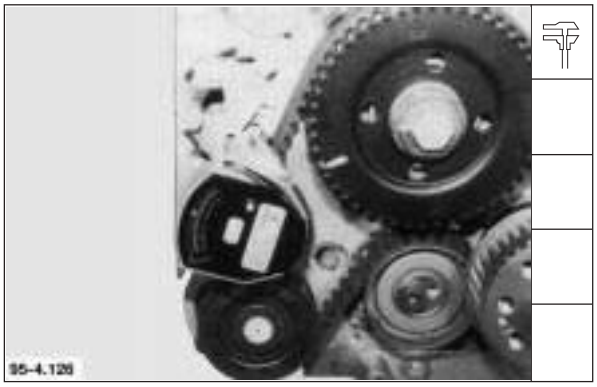


63. Kurbelwelle **4** Umdrehungen in Motordrehrichtung drehen, bis Markierungen in Überdeckung stehen.



64. Zahnriemenspannungs-Meßgerät aufsetzen. Riemenspannung messen.

    Sollwert: Skalenwert **6,5 - 9,5**



65. Wenn der geforderte Skalenwert nicht erreicht wird, muß mit Hilfe der Spannrolle korrigiert werden.

66. Einstellbolzen für Kurbel-und Nockenwelle wieder bis zum Anschlag einschrauben.

English

63. Make **four** complete crankshaft revolutions in direction of engine rotation until marks coincide.

64. Position toothed belt tension gauge. Gauge belt tension.

    Specified
    scale reading: **6.5 - 9.5**

65. If the specified scale reading is not obtained, readjust with idler pulley.

66. Screw adjusting pins for crankshaft and camshaft back in again as far as they will go.

Français

63. Virer le vilebrequin de **4** tours dans le sens de rotation du moteur jusqu'à ce que les repères correspondent.

64. Placer l'appareil de mesure de tension de courroie crantée. Relever la valeur de tension de la courroie.

    Valeur de consigne sur échelle graduée: **6,5 - 9,5**

65. Si la valeur requise sur l'échelle n'est pas atteinte, corriger à l'aide du galet tendeur.

66. Visser à nouveau la pige de calage du vilebrequin et de l'arbre à cames jusqu'en butée.

Español

63. Darle al cigüeñal **4** vueltas en el sentido de giro normal del motor hasta que coincidan las marcas.

64. Colocar el verificador de tensión para correas dentadas. Medir la tensión de la correa.

    Valor prescrito:
    valor de escala **6,5 - 9,5**

65. Si no se alcanza el valor de escala exigida, hay que corregir con ayuda de la polea tensora.

66. Enroscar de nuevo los pernos de ajuste del cigüeñal y árbol de levas hasta que tengan contacto.

English

67. Slacken idler pulley and turn in anti-clockwise direction to obtain a scale reading of **5 - 6.**
Tighten bolt of idler pulley again.

Tightening specification: **45 Nm**

68. Remove adjusting pins and toothed belt tension gauge. Make **4** crankshaft revolutions in direction of engine rotation.

Note: Pay attention camshaft marking.

69. Fit toothed belt tension gauge.
Specified scale reading: **6.5 - 9.5**
Remove toothed belt tension gauge.

Valve timing check

70. Screw camshaft adjusting pin into crankcase as far as it will go.

Note: Bore for camshaft must overlap with bore in crankcase.

Français

67. Desserrer le galet tendeur et virer dans le sens antihoraire jusqu'à obtention d'une valeur de **5 - 6 sur** l'échelle.
Serrer la vis du galet tendeur.

Consigne de serrage: **45 Nm**

68. Oter la pige de calage et l'appareil de mesure de tension puis virer le vilebrequin de **4** tours dans le sens de rotation du moteur.

Nota: attention au repère porté sur l'arbre à cames.

69. Monter l'appareil de mesure de tension de courroie crantée.
Valeur de consigne sur échelle graduée: **6,5 - 9,5**
Déposer l'appareil de mesure de tension de courroie.

Contrôle du calage de la distribution

70. Visser jusqu'en butée la pige de l'arbre à cames pour le calage de la distribution.

Nota: l'alésage de l'arbre à cames doit correspondre à celui du bloc moteur.

Español

67. Soltar la polea tensora y girarla en contra del sentido de las agujas del reloj hasta que se alcance un valor de **5 - 6** en la escala.
Volver a apretar el tornillo de la polea tensora.

Prescripción de apriete: **45 Nm**

68. Retirar los pernos de ajuste y el verificador de tensión. Darle al cigüeñal **4** vueltas en el sentido de giro normal del motor.

Nota: Prestar atención a la marca puesta en la rueda dentada del árbol de levas.

69. Montar el verificador de tensión para correas dentadas.
Valor prescrito: valor de escala **6,5 - 9,5**
Desmontar el verificador de tensión.

Control de las cotas de reglaje

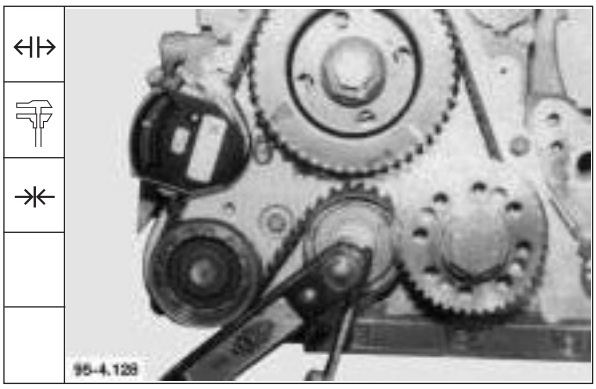
70. Enroscar el perno de ajuste del árbol de levas en el bloque motor hasta que se asiente.

Nota: El orificio para el árbol de levas y el orificio existente en el bloque motor deben coincidir.

Deutsch

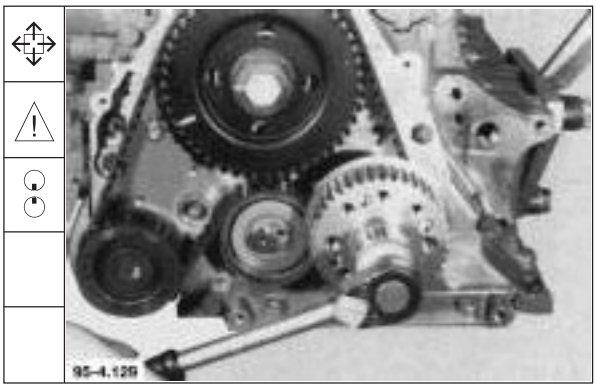
67. Spannrolle lösen und entgegen dem Uhrzeigersinn drehen, so daß ein Skalenwert von **5 - 6** erreicht wird.
    Schraube von Spannrolle wieder festdrehen.

    Anziehvorschrift: **45 Nm**



68. Einstellbolzen und Zahnriemenspannungsmeßgerät entfernen. Kurbelwelle **4** Umdrehungen in Motordrehrichtung drehen.

Hinweis: Auf Markierung der Nockenwelle achten.

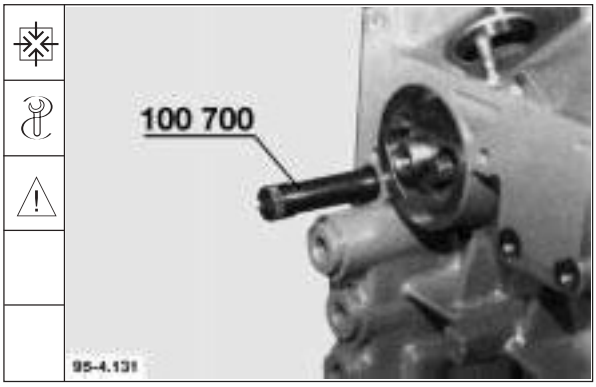


69. Zahnriemenspannungs-Meßgerät montieren.
    Sollwert: Skalenwert **6,5 - 9,5**
    Zahnriemenspannungs-Meßgerät abbauen.

Steuerzeiten-Kontrolle

70. Einstellbolzen für Nockenwelle in das Kurbelgehäuse bis Anlage einschrauben.

Hinweis: Bohrung für Nockenwelle muß mit der Bohrung im Kurbelgehäuse in Überdeckung stehen.



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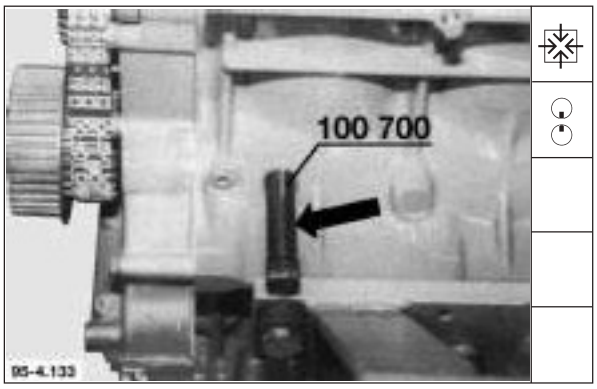
Deutsch

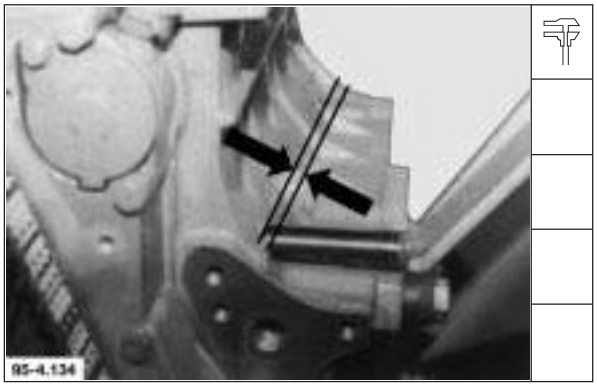
71. Zentralschraube mit Drehmomentschlüssel in Motordrehrichtung **40 Nm** spannen, Drehmomentschlüssel wieder entlasten.

Hinweis: Kurbelwellenstellung nicht mehr verdrehen.



72. Einstellbolzen für Kurbelwelle einschrauben bis er die Kurbelwelle leicht berührt.

    Einstellbolzen-Stellung zeichnen.



73. Die richtige Einstellung ist dann gegeben, wenn sich der Einstellbolzen noch **0,75** bis **2,25** Umdrehungen bis zur Anlage ins Kurbelgehäuse eindrehen läßt.

Hinweis: Wird die Einschraubtiefe des Einstellbolzens an das Kurbelgehäuse nicht erreicht, ist die Nockenwellengrundeinstellung zu wiederholen.

Hierzu Nockenwellenzahnriemenrad und Spannrolle lösen.
Vorgang ab Punkt **55** wiederholen.

English

71. Tighten central bolt with torque wrench **40 Nm** in direction of engine rotation, unload torque wrench again.

Note: Do not change crankshaft position anymore.

72. Screw in crankshaft adjusting pin until it has slight contact with crankshaft.

    Mark position of adjusting pin.

73. The setting is correct when the adjusting pin can still be screwed into the crankcase another **0.75 to 2.25** turns until stop.

Note: If the adjusting pin cannot be screwed into crankcase over its full effective length, the basic camshaft setting has to be redone.

Release camshaft toothed belt gear again for this purpose. Repeat procedure as from point **55**.

Français

71. A l'aide de la clé dynamométrique serrer la vis centrale à **40 Nm** dans le sens de rotation du moteur, ensuite soulager à nouveau la clé dynamométrique.

Nota: ne plus modifier la position du vilebrequin.

72. Visser la pige de calage du vilebrequin jusqu'à ce qu'elle soit en contact avec le vilebrequin.

    Repérer la position de la pige de réglage.

73. Le bon calage est obtenu au moment où l'on peut encore tourner dans le bloc moteur la pige de **0,75 à 2,25** tours jusqu'en butée.

Nota: si la profondeur de vissage de la pige de calage n'est pas atteinte, refaire le calage de base de l'arbre à cames.

Pour cela desserrer le pignon de la courroie dentée de l'arbre à cames et le galet tendeur.
Répéter opérations à partir du pt. **55**.

Español

71. Utilizando la llave dinamométrica, apretar el tornillo central con **40 Nm** en el sentido de giro normal del motor. Volver a descargar la llave dinamométrica.

Nota: A partir de este momento, mantener inalterada la posición del cigüeñal.

72. Enroscar el perno de ajuste del cigüeñal hasta que tenga ligero contacto con éste.

    Marcar la posición del perno de ajuste.

73. El ajuste es correcto, si se puede seguir girando el perno en el bloque motor unas **0,75 a 2,25 vueltas** hasta que se asiente.

Nota: Si no se alcanza la profundidad de penetración del perno de ajuste en el bloque motor, es preciso repetir el ajuste básico del árbol de levas.

A tal objeto hay que soltar la rueda de correa dentada del árbol de levas y la polea tensora. Repetir la operación a partir del punto **55**.

English

74. Remove adjusting pins for camshaft and crankshaft.

74.1 Tighten screw plug with new Cu seal.

Tightening specification: **18 ± 2 Nm**

Note: Use thin socket a/flats 14.

74.2 Tighten screw plug with new Cu seal.

Tightening specification: **18 ± 2 Nm**

74.3 Refit cover together with gasket. Tighten bolts.

Tightening specification: **4.5 Nm**

Français

74. Oter la pige de calage de l'arbre à cames et du vilebrequin.

74.1 Bloquer vis filetée en utilisant un joint d'étanchéité neuf en Cu.

Consigne de serrage: **18 ± 2 Nm**

Nota: utiliser douille de 14.

74.2 Bloquer vis filetée en utilisant un joint d'étanchéité neuf en Cu.

Consigne de serrage: **18 ± 2 Nm**

74.3 Remonter le couvercle avec un joint neuf. Serrer les vis.

Consigne de serrage: **4,5 Nm**

Español

74. Quitar los pernos de ajuste del árbol de levas y cigüeñal.

74.1 Apretar el tapón provisto de una junta anular nueva de cobre.

Prescripción de apriete: **18 ± 2 Nm**

Nota: Usar una llave de vaso delgado de 14.

74.2 Apretar el tapón provisto de una junta anular nueva de cobre.

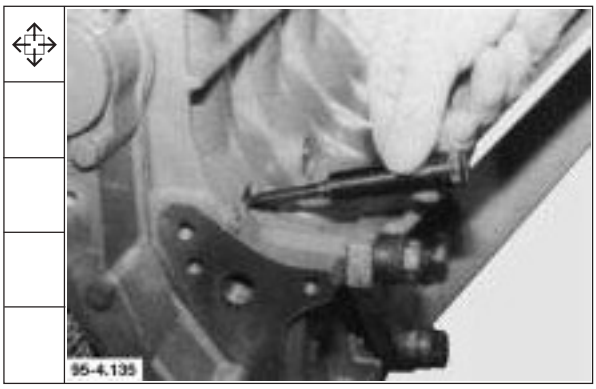
Prescripción de apriete: **18 ± 2 Nm**

74.3 Volver a montar la tapa con junta. Apretar los tornillos.

Prescripción de apriete: **4,5 Nm**

Deutsch

74. Einstellbolzen für Nocken- und Kurbelwelle entfernen.



74.1 Verschlußschraube mit neuem Cu-Dichtring festdrehen.

Anziehvorschrift: **18 ± 2 Nm**

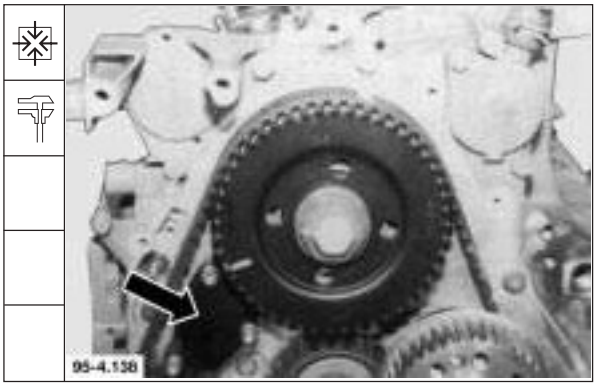
Hinweis: Dünne Stecknuß SW 14 verwenden.

74.2 Verschlußschraube mit neuem Cu-Dichtring festdrehen.

Anziehvorschrift: **18 ± 2 Nm**

74.3 Deckel mit Dichtung wieder montieren. Schrauben festdrehen.

Anziehvorschrift: **4,5 Nm**



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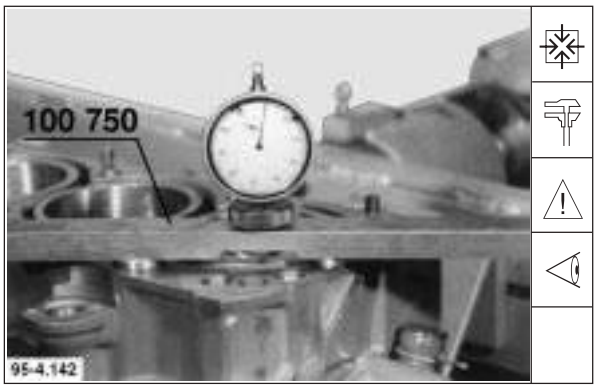
Deutsch

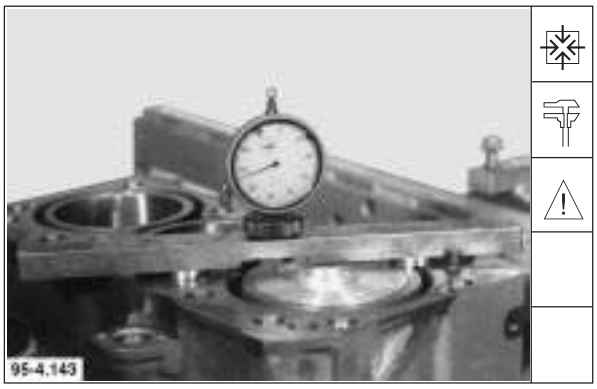


Zylinderkopf

75. Zylinderkopfdichtung bestimmen

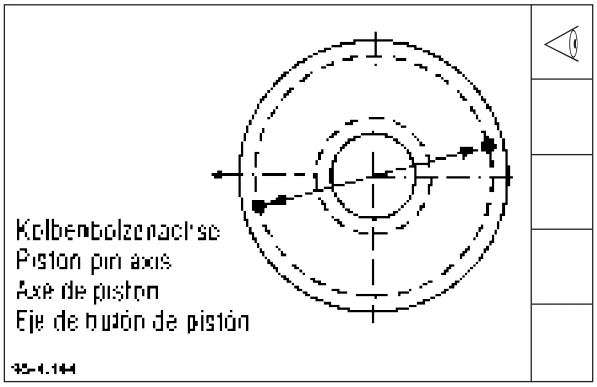
75.1 Abstandsplättchen auf die Dichtfläche des Zylinderkurbelgehäuses legen und Meßuhr auf „0“ stellen.

Hinweis: Bei Vorhandensein der Slip-fit-Buchsen Abstandsplättchen nicht auf den Buchsenbund auflegen.



75.2 Meßuhr an den Meßstellen auf den Kolben setzen und den größten Kolbenüberstand ermitteln.

Hinweis: Alle Kolben müssen vermessen werden.



75.3 Meßpunkte beachten.

76. Größten Wert mit der Tabelle vergleichen und entsprechende Zylinderkopfdichtung ermitteln.

Kolbenüberstand	Kennzeichnung der Zylinderkopfdichtung
0,530 - 0,69 mm	1 Kerbe
0,691 - 0,76 mm	2 Kerben
0,761 - 0,83 mm	3 Kerben

English

Cylinder head

75. Determine cylinder head gasket.

75.1 Place spacers on sealing surface of crankcase with integrated liners and set dial gauge to „0“.

Note: If slip fit liners are installed do not place any spacers on liner seating.

75.2 Position dial gauge on piston at gauge points and determine max. piston projection.

Note: All pistons must be gauged.

75.3 Pay attention to gauge points.

76. Compare max. value with table and determine appropriate cylinder head gasket.

Piston projection	Marking of cylinder head gasket
0.590 - 0.69 mm	1 notch
0.691 - 0.76 mm	2 notches
0.761 - 0.83 mm	3 notches

Français

Culasse

75. Déterminer le joint de culasse.

75.1 Poser des plaquettes d’écartement sur la surface d’étanchéité du bloc moteur et mettre le comparateur à „0“.

Nota: en présence de chemises slip-fit ne pas placer de plaquettes d’écartement sur la collerette.

75.2 Placer le comparateur sur le piston aux points de mesure et déterminer la cote de dépassement la plus grande du piston.

Nota: le relevé des cotes doit être fait sur tous les pistons.

75.3 Respecter les points de mesure.

76. Comparer la plus grande valeur avec le tableau et définir le joint de culasse correspondant

Dépassement de piston	Identification du joint de culasse
0,590 - 0,69 mm	1 encoche
0,691 - 0,76 mm	2 encoches
0,761 - 0,83 mm	3 encoches

Español

Culata

75. Determinación de la junta de culata.

75.1 Colocar las plaquitas distanciadoras sobre la superficie de cierre del bloque de cilindros y poner el comparador a „0“.

Nota: Si existen camisas slipfit, cuidar de no colocar las plaquitas sobre el reborde de estas camisas.

75.2 Colocar el comparador en los puntos de medición sobre el pistón y determinar el saliente de pistón más grande.

Nota: Esta medición deberá hacerse en todos los pistones.

75.3 Observar los puntos de medición.

76. Comparar el valor más grande con la tabla y definir la junta de culata correspondiente.

Saliente de piston	Marcación de la junta de culata
0,590 - 0,69 mm	1 encoche
0,691 - 0,76 mm	2 encoches
0,761 - 0,83 mm	3 encoches

English

77. Make sure that dowel pins are fitted.

78. Position cylinder head gasket.

Note: Sealing surfaces for cylinder head gasket must be free of oil.

79. Install cylinder head. Oil cylinder head bolts lightly.

Note: Standard length of cylinder head bolt: **185 ± 0.8 mm**

79.1 Tighten cylinder head bolts.

Tightening specification:
Initial tightening torque:

1st stage	**30 Nm**
2nd stage	**80 Nm**
3rd stage	**160 Nm**
Tightening angle:	**90°**

Note: Observe tightening order for cylinder head bolts. See Specification Data.

Français

77. Veiller à la présence des goupilles de serrage.

78. Placer le joint de culasse.

Nota: les surfaces d'étanchéité du joint de culasse doivent être exemptes d'huile.

79. Monter la culasse. Huiler légèrement les vis de culasse.

Nota: longueur normale d'une vis de culasse: **185 ± 0,8 mm**

79.1 Serrer les vis de culasse.

Consigne de serrage:
Valeur de préserrage:

1re phase	**30 Nm**
2e phase	**80 Nm**
3e phase	**160 Nm**
Serrage à l'angle	**90°**

Nota: respecter l'ordre de serrage des vis de culasse. Voir chapitre Caractéristiques techniques.

Español

77. Prestar atención a que existan los pasadores de ajuste.

78. Colocar la junta de culata.

Nota: Las superficies de cierre o asiento de la junta de culata deben estar exentas de aceite.

79. Montar la culata. Untar con un poco de aceite los tornillos de culata.

Nota: Longitud del tornillo de culata normal: **185 ± 0,8 mm**

79.1 Apretar los tornillos de culata.

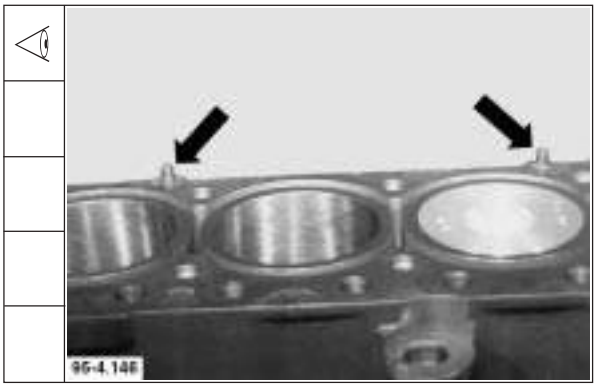
Prescripción de apriete:
Apriete inicial:

1er fase	**30 Nm**
2o fase	**80 Nm**
3er fase	**160 Nm**
Angulo de reapriete:	**90°**

Nota: Observar el orden de sucesión en el apriete de los tornillos de culata.
Ver Datos técnicos.

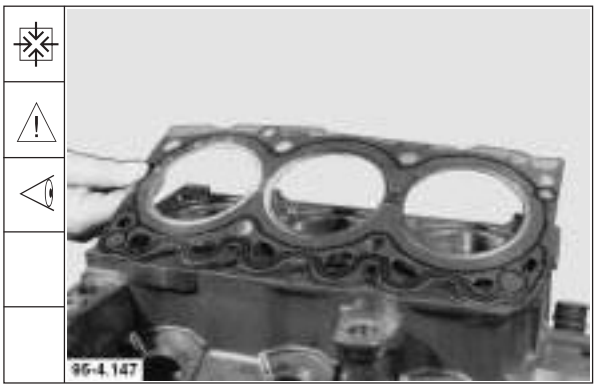
Deutsch

77. Auf Vorhandensein der Spannstifte achten.



78. Zylinderkopfdichtung auflegen.

Hinweis: Dichtflächen für die Zylinderkopfdichtung müssen ölfrei sein.



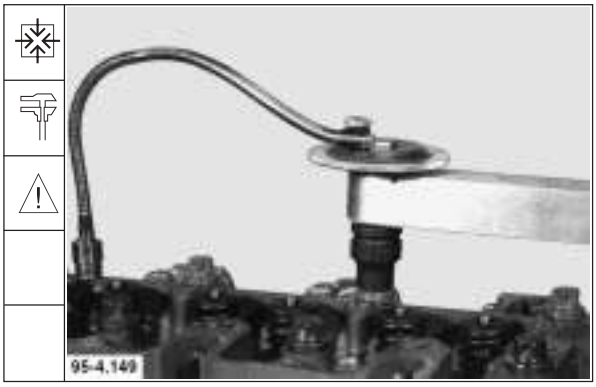
79. Zylinderkopf montieren. Zylinderkopfschrau-ben leicht einölen.

Hinweis: Länge der Zylinderkopfschraube normal: **150 ± 0,8 mm**

79.1 Zylinderkopfschrauben festdrehen.

Anziehvorschrift:		
Vorspannwert:	1. Stufe	**30 Nm**
	2. Stufe	**80 Nm**
	3. Stufe	**160 Nm**
Nachspannwinkel:		**90°**

Hinweis: Reihenfolge beim Anziehen der Zylinderkopfschrauben beachten. SieheTechn. Daten



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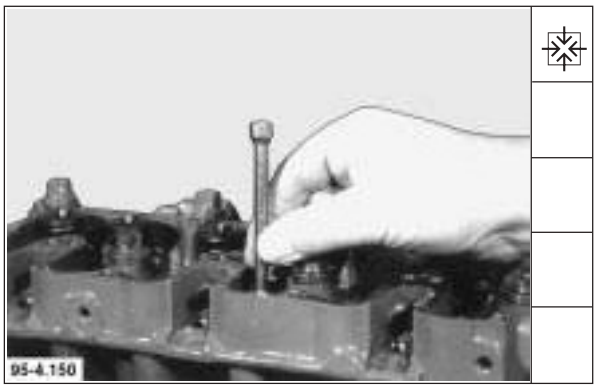
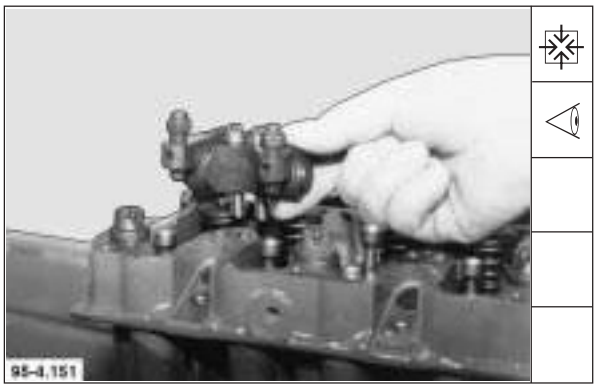


Ventiltrieb

80. Stoßstangen einsetzen.

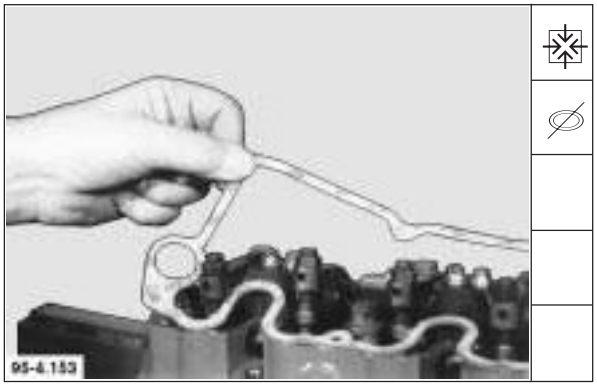


81. Kipphebelbock montieren und zu den Stoßstangen/Ventilen ausrichten.

82. Schrauben festdrehen.

    Anziehvorschrift: **21 Nm**

Hinweis: Ventilspiel einstellen siehe Kapitel 2.



83. Dichtung aufsetzen.

English

Valve gear

80. Insert pushrods.

81. Fit rocker arm bracket and align relative to pushrods/valves.

82. Tighten bolts.

    Tightening specification: **21 Nm**

Note: Adjust valve clearance - see Chapter 2.

83. Place on gasket.

Français

Commande des soupapes

80. Mettre en place les tiges de culbuteurs.

81. Monter support de culbuteurs et l'ajuster par rapport aux tiges de culbuteurs et soupapes.

82. Serrer les vis.

    Consigne de serrage **21 Nm**

Nota: réglage du jeu aux soupapes voir chapitre 2.

83. Placer un joint.

Español

Accionamiento de las válvulas

80. Introducir las varillas de empuje.

81. Montar el soporte de balancines y alinearlo con respecto a las varillas de empuje/válvulas.

82. Apretar los tornillos.

    Prescripción de apriete: **21 Nm**

Nota: Ajustar el juego de válvulas, ver cap. 2.

83. Colocar la junta.

English

84. Fit cylinder head cover. Tighten bolts.

Tightening specification: **8.5 Nm**

Air intake manifold/exhaust manifold

85. Mount air intake manifold with new gaskets.

86. Tighten bolts.

    Tightening specification: **21 Nm**

87. Mount exhaust manifold with new gaskets.

Note: Apply **DEUTZ S1** Never Seize paste to bolts.

Français

84. Monter le cache-culbuteurs. Serrer les vis.

Consigne de serrage: **8,5 Nm**

Collecteur d'admission/collecteur d'échappement

85. Monter le collecteur d'admission avec des joints neufs.

86. Serrer les vis.

Consigne de serrage: **21 Nm**

87. Monter le collecteur d'échappement en utilisant des joints neufs.

Nota: enduire les vis de pâte **DEUTZ S1** Never Seize.

Español

84. Montar la tapa de culata: Apretar los tornillos.

Prescripción de apriete: **8,5 Nm**

Colector de admisión/colector de escape

85. Montar el colector de admisión con juntas nuevas.

86. Apretar los tornillos.

    Prescripción de apriete: **21 Nm**

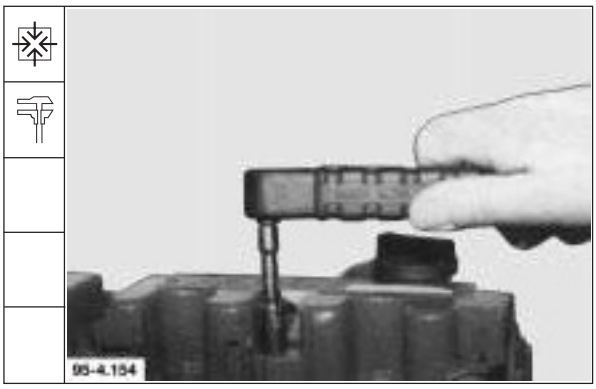
87. Montar el colector de escape con juntas nuevas.

Nota: Aplicar pasta **DEUTZ S1** Never Seize a los tornillos.

Deutsch

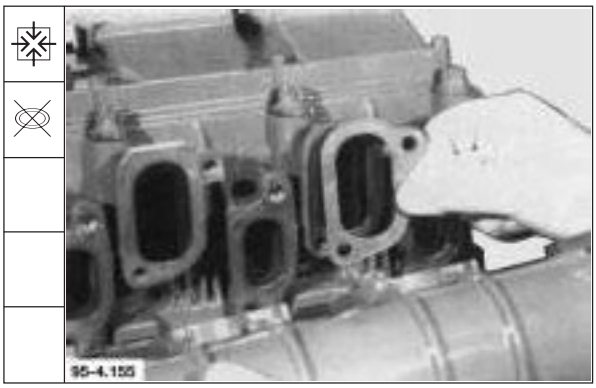
84. Zylinderkopfhaube montieren. Schrauben festdrehen.

    Anziehvorschrift: **8,5 Nm**



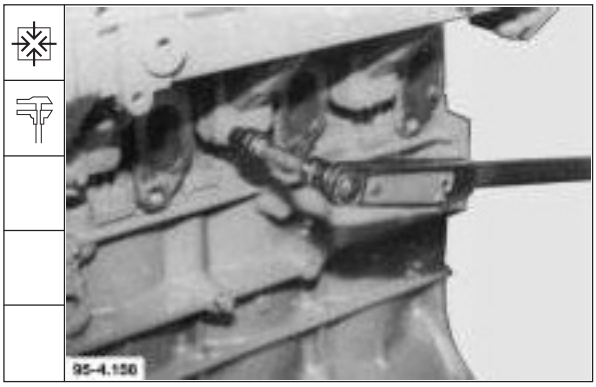
Luftansaugrohr/Abgassammelrohr

85. Luftansaugrohr mit neuen Dichtungen anbauen.



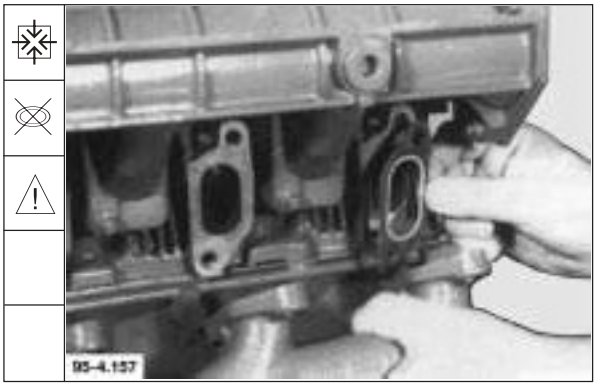
86. Schrauben festdrehen.

    Anziehvorschrift: **21 Nm**



87. Abgassammelrohr mit neuen Dichtungen anbauen.

Hinweis: Schrauben mit **DEUTZ S1** Never Seize Paste einstreichen.



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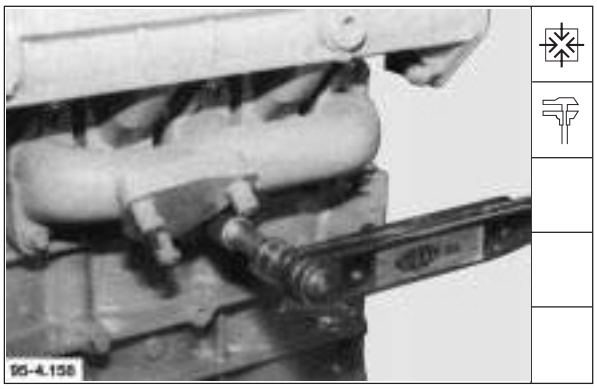
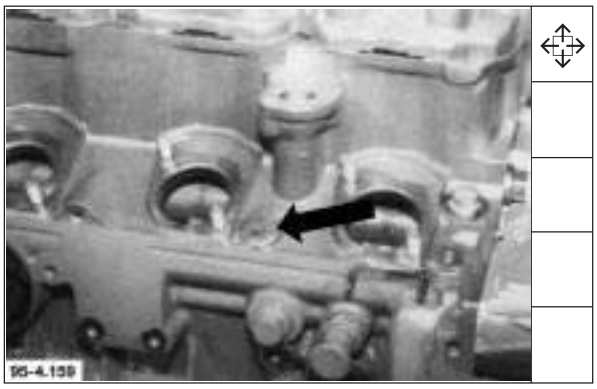
Deutsch



88. Schrauben festdrehen.

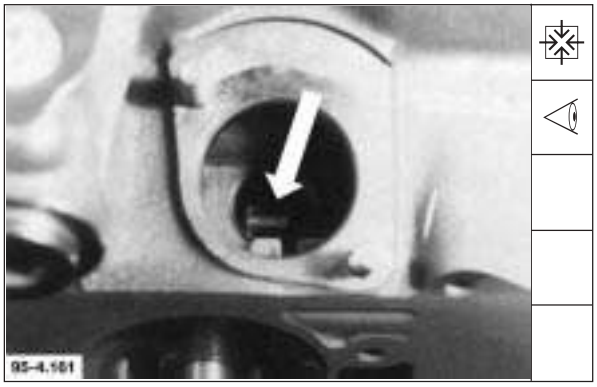
    Anziehvorschrift: **40 Nm**



Einspritzpumpe

89. Verschlußschraube am Kurbelgehäuse herausschrauben.

90. Regelstange in Mittelstellung bringen. Einstellbolzen für Regelstange in das Kurbelgehäuse bis Anlage einschrauben.



91. **Nockenwelle drehen, bis Stößelhub des jeweiligen Zylinders auf UT steht.**

4

English

88. Tighten bolts.

Tightening specification: **40 Nm**

Injection pump

89. Undo screw plug on crankcase.

90. Bring control rod in central position.
Screw adjusting pin for control rod into crankcase as far as it will go.

91. **Rotate camshaft until tappet stroke of respective cylinder is at BDC.**

Français

88. Serrer les vis.

Consigne de serrage: **40 Nm**

Pompe d'injection

89. Dévisser la vis filetée du bloc moteur.

90. Placer la crémaillère en position milieu. Visser la pige de réglage de la crémaillère dans le bloc moteur jusqu'en position de butée.

91. **Virer l'arbre à cames jusqu'à ce que le poussoir du cylindre considéré soit au PMB.**

Español

88. Apretar los tornillos.

Prescripción de apriete: **40 Nm**

Bomba de inyección

89. Desenroscar el tapón del bloque motor.

90. Situar la cremallera en posición media.
Enroscar el perno de ajuste de la cremallera en el bloque motor hasta que se asiente.

91. **Girar el árbol de levas hasta que la carrera del empujador del respectivo cilindro se encuentre en PMI.**

English

92. Fit injection pump tappet.

Note: Use flexible magnetic lifter.

93. **Determining compensating gasket**

93.1 Gauge depth dimension „A“ between crankcase contact surface and spring plate contact surface of tappet.

94. Installation dimension „X“ of injection pump

B/FL 1011 F engines installation dimension „X“ = **58 mm**
B/FM 1011 F engines installation dimension „X“ = **59 mm**

Note: The installation dimension „X“ only serves for calculation of shims.

Français

92. Monter le poussoir de la pompe d’injection.

Nota: utiliser un extracteur magnétique souple.

93. **Détermination des cales de réglage**

93.1 Relever la cote „A“ entre le plan d’appui du joint et le plan d’appui de la cuvette du ressort au niveau du poussoir.

94. Cote de montage „X“ de la pompe d’injection

B/FL 1011 F - cote de montage „X“ = **58 mm**
B/FM 1011 F - cote de montage „X“ = **59 mm**

Nota: la cote de montage „X“ sert uniquement au calcul des cales d’épaisseur.

Español

92. Montar el empujador de la bomba de inyección.

Nota: Usar el elevador magnético flexible.

93. **Determinación de la junta de compensación.**

93.1 Determinar la medida de profundidad „A„ desde el asiento en el bloque motor hasta el asiento del plato de resorte en el empujador.

94. Medida de montaje „X„ de la bomba de inyección.

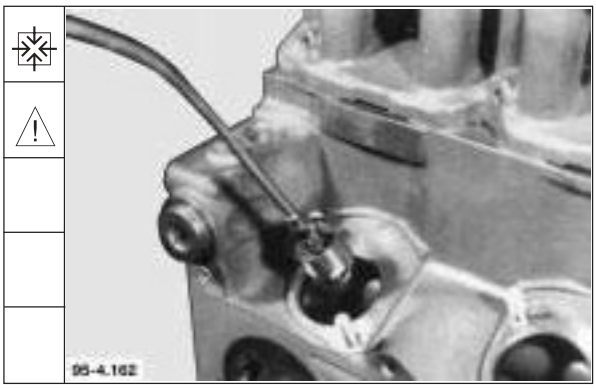
B/FL 1011 F valor „X“ = **58 mm**
B/FM 1011 F valor„X“ = **59 mm**

Nota: La medita de montaje „X“ sirve solamente para la determinación de las arandelas de compensación.

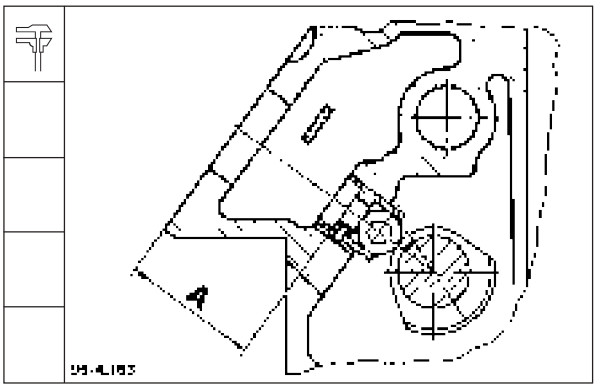
Deutsch

92. Einspritzpumpenstößel montieren.

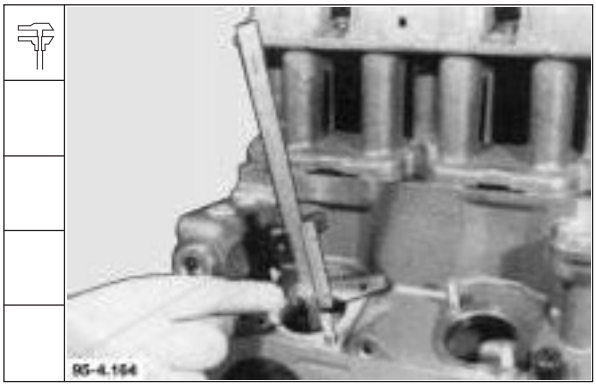
Hinweis: Biegsamen Magnetheber verwenden.



93. **Ermittlung der Ausgleichdichtung.**



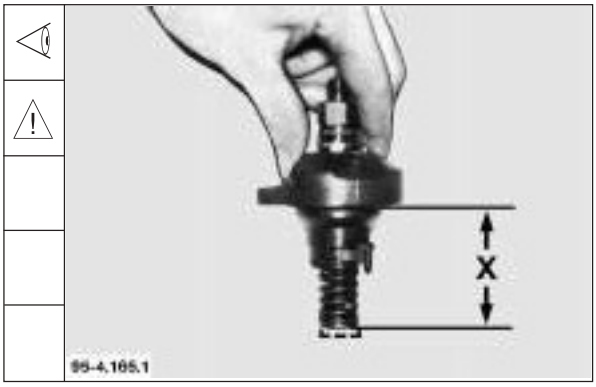
93.1 Tiefenmaß „A“ von der Kurbelgehäuseauflage bis Federtelleraufl age am Stößel messen.



94. Einbaumaß „X“ der Einspritzpumpe.

B/FL 1011 F	Einbaumaß „X“ = **58 mm**
B/FM 1011 F	Einbaumaß „X“ = **59 mm**

Hinweis: Das Einbaumaß „X“ dient nur zur Berechnung der Ausgleichscheiben .



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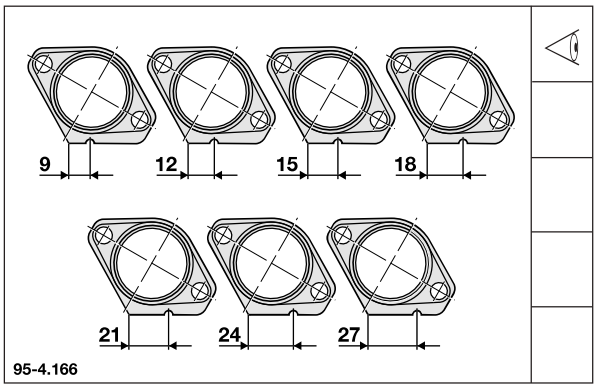
Deutsch

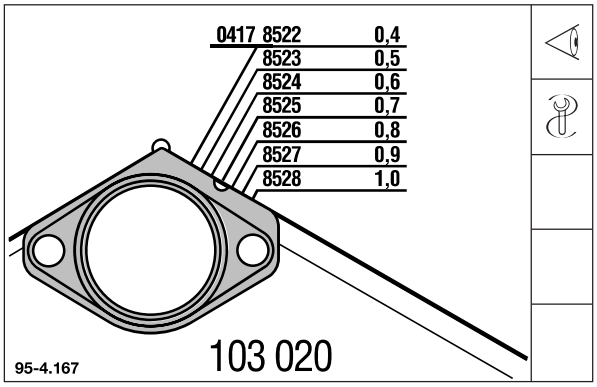
95. Differenz zwischen Einbaumaß „X“ und Tiefenmaß „A“ ermitteln.

Beispiel: Einbaumaß „X“ = 58,00 mm
- Tiefenmaß „A“ = 57,35 mm
Differenz = **0,65** mm



96. Ausgleichdichtung nach Tabelle entsprechend der Kennzeichnung auswählen.

Ermittelte Differenz	Maß der Kennzeichnung
bis 0,4 mm	9 mm
0,401 - 0,5 mm	12 mm
0,501 - 0,6 mm	15 mm
0,601 - 0,7 mm	18 mm
0,701 - 0,8 mm	21 mm
0,801 - 0,9 mm	24 mm
0,901 - 1,0 mm	27 mm



96.1 Da die Teile-Nr. und die Dichtungsdicke auf der Ausgleichdichtung nicht angegeben ist kann mit Hilfe des Werkzeuges die Dichtungsdicke nachgeprüft werden.

97. Entsprechende Ausgleichdichtung auflegen.

Hinweis: Einbaulage beachten.

English

95. Determine difference between installation dimension „X“ and depth dimension „A“.

Example:

Installation dimension „X“	= 58.00 mm
- Depth dimension „A“	= 57.35 mm
Difference	= **0.65 mm**

96. Select compensating gasket from table according to marking.

Determined difference	Marked dimension
up to 0.4 mm	9 mm
0.401 - 0.5 mm	12 mm
0.501 - 0.6 mm	15 mm
0.601 - 0.7 mm	18 mm
0.701 - 0.8 mm	21 mm
0.801 - 0.9 mm	24 mm
0.901 - 1.0 mm	27 mm

96.1 As the part No. and gasket thickness are not indicated on the compensating gasket the gasket thickness can be rechecked with the tool.

97. Place on appropriate compensating gasket.

Note: Watch installation position.

Français

95. Calculer la différence entre la valeur de montage „X“ et la cote de profondeur „A“.

Exemple:

valeur de montage „X“	= 58,00 mm
- cote de profondeur „A“	= 57,35 mm
différence	= **0,65 mm**

96. Sélectionner selon la liste ci-après et conformément au repérage la cale de réglage voulue.

Calcul de la différence	Cote de repérage
jusqu’à 0,4 mm	9 mm
0,401 - 0,5 mm	12 mm
0,501 - 0,6 mm	15 mm
0,601 - 0,7 mm	18 mm
0,701 - 0,8 mm	21 mm
0,801 - 0,9 mm	24 mm
0,901 - 1,0 mm	27 mm

96.1 Comme le numéro des pièces et l’épaisseur de la cale ne sont pas indiqués sur la cale contrôler l’épaisseur à l’aide de l’outil.

97. Placer la cale de réglage correspondante.

Nota: veiller au sens de montage.

Español

95. Determinar la diferencia entre la medida de montaje „X„ y la de profundidad „A“.

Ejemplo:

Medida de montaje „X“	= 58,00 mm
- profundidad „A“	= 57,35 mm
Diferencia	= **0,65 mm**

96. Elegir la junta de compensación según la tabla y medida de identificación.

Diferencia determinada	Medita de identificación
jusqu’à 0,4 mm	9 mm
0,401 - 0,5 mm	12 mm
0,501 - 0,6 mm	15 mm
0,601 - 0,7 mm	18 mm
0,701 - 0,8 mm	21 mm
0,801 - 0,9 mm	24 mm
0,901 - 1,0 mm	27 mm

96.1 Dado que el número de pieza y el espesor de la junta de compensación no están indicados en ésta, se puede comprobar el espesor con ayuda de la herramienta adecuada.

97. Colocar la junta de compensación que corresponda.

Nota: Observar la posición de montaje.

English

98. Remove blanking pin from injection pump.

99. Before fitting injection pump, make sure that locking wire is engaged in control lever.

100. Fit injection pump in place. Then press pump down to its seat, taking care that it is accurately centered. Tighten nuts.

    Tightening specification: **21 Nm**

101. Take locking wire out.

Français

98. Retirer le pion obturateur de la pompe d'injection.

99. Avant de monter la pompe d'injection veiller à ce que le fil d'arrêt soit bien inséré dans le levier articulé.

100. Monter la pompe d'injection. La baisser en la centrant jusqu'en position de butée. Serrer les écrous

    Consigne de serrage: **21 Nm**

101. Retirer le fil d'arrêt.

Español

98. Sacar el pasador de cierre de la bomba de inyección.

99. El alambre de sujeción debe estar enclavado en la palanca de articulación antes de montar la bomba de inyección.

100. Montar la bomba de inyección y presionarla céntricamente hacia abajo hasta que se asiente. Apretar las tuercas.

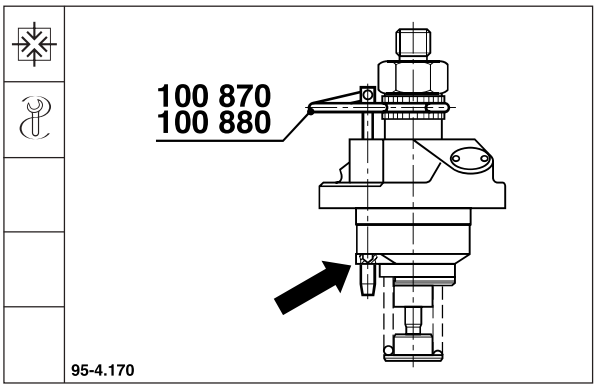
    Prescripción de apriete: **21 Nm**

101. Retirar el alambre de sujeción.

Deutsch

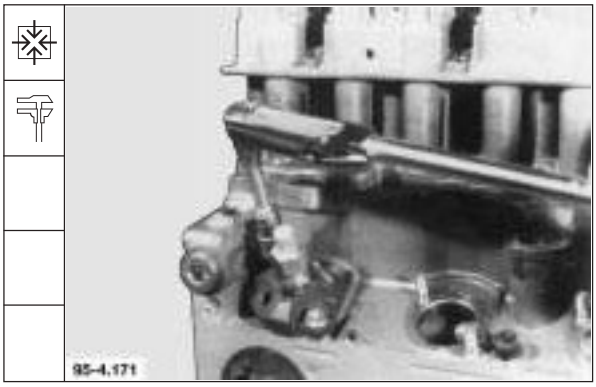
98. Verschlußstift aus der Einspritzpumpe herausnehmen.

99. Vor Montage der Einspritzpumpe ist darauf zu achten, daß der Arretierungsdraht in den Anlenkhebel eingerastet ist.



100. Einspritzpumpe montieren. Einspritzpumpe zentrisch bis Auflage hinunterdrücken. Muttern festdrehen.

Anziehvorschrift: **21 Nm**



101. Arretierungsdraht herausziehen.

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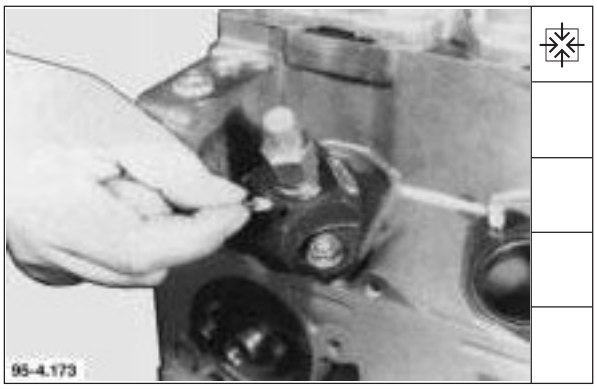
Deutsch



102. Bohrung mit Verschlußstift verschließen.

103. Einstellbolzen für Regelstange entfernen.

104. Verschlußschraube mit neuem Cu-Dichtring festdrehen.

Anziehvorschrift: **18 Nm**

4

English	Français	Español
102. Blank bore with pin.	102. Obturer l'alésage à l'aide du pion.	102. Cerrar el orificio mediante el pasador de cierre.
103. Remove adjusting pin for control rod.	103. Oter la pige de réglage de la crémaillère.	103. Retirar el perno de ajuste de la cremallera.
104. Tighten screw plug with new Cu seal. Tightening specification: **18 Nm**	104. Serrer vis filetée en renouvellant bague d'étanchéité en Cu. Consigne de serrage: **18 Nm**	104. Apretar el tapón provisto de una junta anular nueva de cobre. Prescripción de apriete: **18 Nm**

English

Injectors

105. Slide sealing ring over injector using some grease.

106. Insert injector.

Note: Leakage fuel connection must point towards exhaust side.

107. Fit clamping pad.

Note: Watch installation position of clamping pad.

108. Tighten bolt.

Tightening specification: **21 Nm**

Français

Injecteurs

105. En l'enduisant d'un peu de graisse glisser le joint d'étanchéité sur l'injecteur.

106. Mettre en place l'injecteur.

Nota: raccord conduite de récupération doit être dirigé vers la partie échappement.

107. Placer la griffe de serrage.

Nota: veiller au sens de montage de la patte de serrage.

108. Serrer la vis.

Consigne de serrage: **21 Nm**

Español

Inyectores

105. Colocar la junta anular con un poco de grasa sobre el inyector.

106. Introducir el inyector.

Nota: El empalme de combustible sobrante debe indicar hacia el lado de escape.

107. Colocar la garra de sujeción.

Nota: Observar la posición de montaje de la garra.

108. Apretar el tornillo.

Prescripción de apriete: **21 Nm**

Deutsch

Einspritzventile

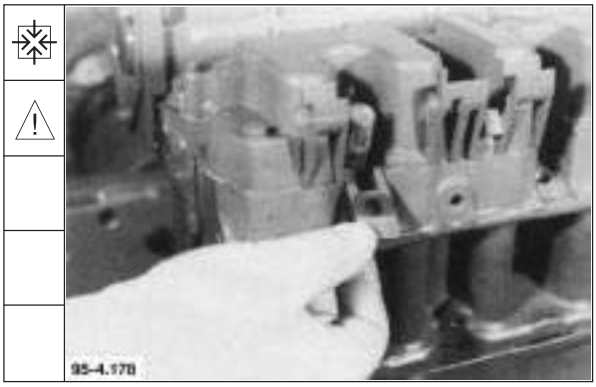
105. Dichtring mit etwas Fett auf das Einspritzventil aufschieben.

106. Einspritzventil einsetzen.

Hinweis: Leckölanschluß muß zur Abgasseite weisen.

107. Spannpratze aufsetzen.

Hinweis: Einbaulage der Spannpratze beachten.



108. Schraube festdrehen.

Anziehvorschrift: **21 Nm**

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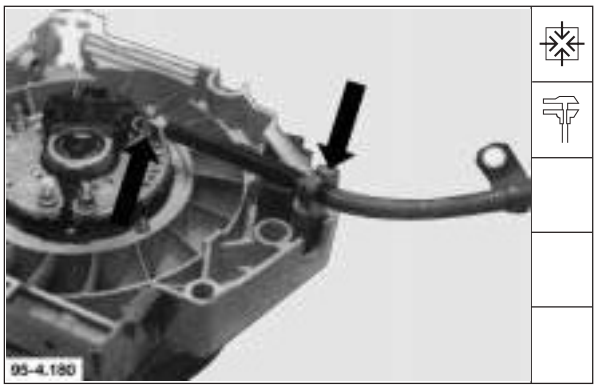
Deutsch



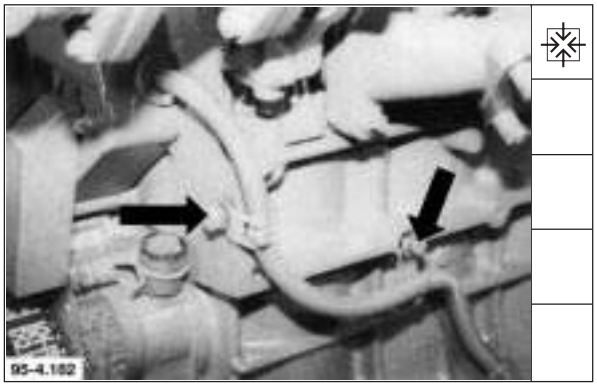
Kühlgebläse

109. Ladestromleitung an Anschluß B+ montieren. Mutter festdrehen. Gummimuffe anbauen.

     Anziehvorschrift: **5 Nm**

110. Kühlgebläse anbauen. Schrauben festdrehen.

     Anziehvorschrift: **22 Nm**



111. Ladestromleitung verschellen.

Kraftstoffleitung / Einspritzleitungen

112. Profilgummi auf Spannstifte aufschieben

4

English

Blower

109. Fit charging current line to connection B+. Tighten nut. Fit rubber sleeve.

     Tightening specification: **5 Nm**

110. Mount blower. Tighten bolts.

     Tightening specification: **22 Nm**

111. Secure charging current line with clips.

Fuel line/injection lines

112. Slide on rubber profile on dowel pins.

Français

Turbine de refroidissement

109. Monter conduite de courant de charge au branchement B+. Serrer écrou et monter manchon en caoutchouc.

     Consigne de serrage: **5 Nm**

110. Monter turbine de refroidissement. Serrer les vis.

     Consigne de serrage: **22 Nm**

111. Fixer conduite de courant de charge à l'aide d'un collier.

Conduite d'alimentation/conduites de refoulement

112. Insérer caoutchouc profilé sur goupilles de serrage.

Español

Ventilador de refrigeración

109. Acoplar el cable de corriente de carga a la conexión B+. Apretar la tuerca. Montar el manguito de goma.

     Prescripción de apriete: **5 Nm**

110. Montar el ventilador de refrigeración. Apretar el tornillo.

     Prescripción de apriete: **22 Nm**

111. Fijar el cable de corriente de carga mediante abrazaderas.

Tubería de combustible/tuberías de inyección

112. Colocar el perfil de goma sobre los pasadores de sujeción.

English

113. Mount fuel line with new Cu seals. Tighten banjo bolts.

Tightening specification: **29 ± 2 Nm**

114. Mount injection lines and tighten.

Tightening specification: **22 + 2 Nm**

115. Mount new leakage fuel line.

Note: The leakage fuel line must always be renewed.

115.1 Fasten overflow line to fuel line using Cobra clamp pliers.

Note: Use Cobra clamp pliers.

Français

113. Monter conduite avec joints d'étanchéité neufs en Cu. Serrer les vis creuses.

Consigne de serrage: **29 ± 2 Nm**

114. Monter et serrer conduites de refoulement.

Consigne de serrage: **22 + 2 Nm**

115. Monter une tubulure de retour des fuites neuve.

Nota: toujours remplacer la tubulure de retour de fuites.

115.1 Utiliser la pince Cobra pour fixer le conduit de trop-plein sur la conduite d'alimentation de combustible.

Nota: utiliser la pince de serrage Cobra.

Español

113. Montar la tubería de combustible con juntas anulares nuevas de cobre. Apretar los tornillos racores.

Prescripción de apriete: **29 ± 2 Nm**

114. Montar las tuberías de inyección y apretar.

Prescripción de apriete: **22 + 2 Nm**

115. Montar una tubería de combustible sobrante nueva.

Nota: La tubería de combustible sobrante deberá ser sustituida, en todos los casos, por otra nueva.

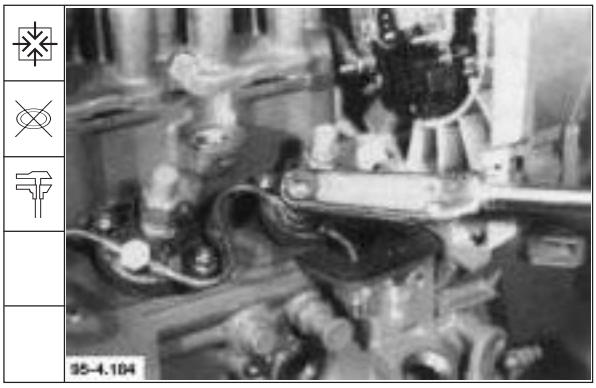
115.1 Sujetar la tubería de rebose a la de combustible por medio de una abrazadera Cobra.

Nota: Utilizar las tenzas Cobra.

Deutsch

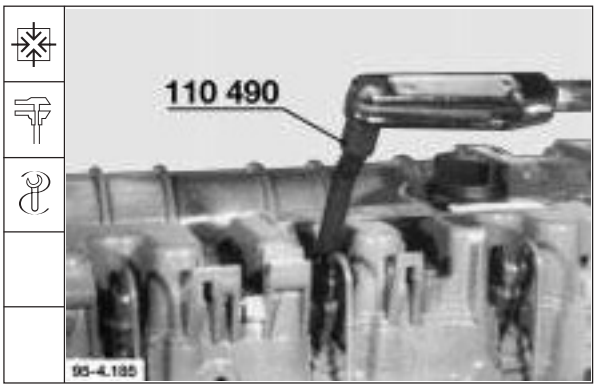
113. Kraftstoffleitung mit neuen Cu-Dichtringen anbauen. Hohlschrauben festdrehen.

Anziehvorschrift: **29 ± 2 Nm**



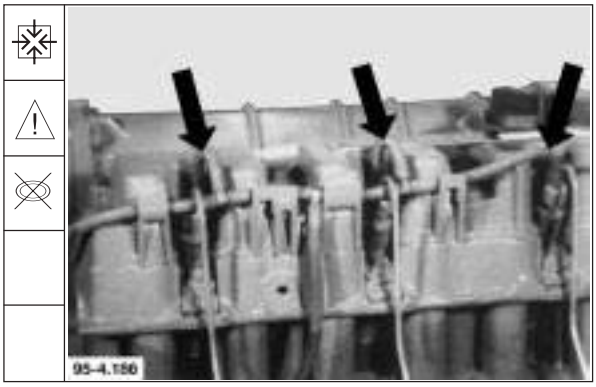
114. Einspritzleitungen anbauen und festdrehen.

Anziehvorschrift: **22 + 2 Nm**



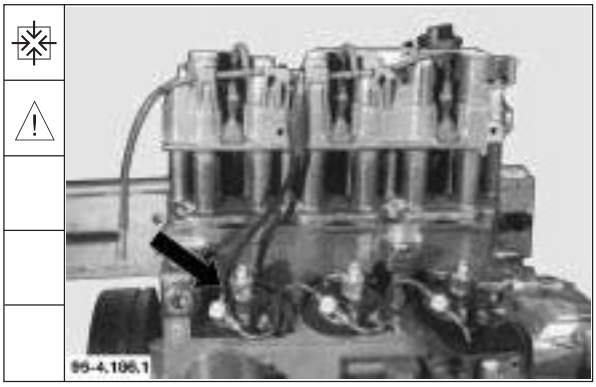
115. Neue Leckölleitung anbauen.

Hinweis: Die Leckölleitung ist grundsätzlich zu erneuern.



115.1 Überströmleitung an Kraftstoffleitung mit Cobraklemme befestigen.

Hinweis: Cobraklemmenzange benutzen.



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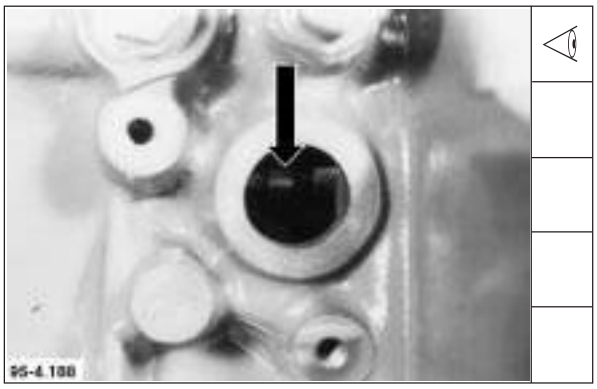
Deutsch

Kraftstofförderpumpe / Kraftstoffilter

116. Neuen Runddichtring auflegen.



117. Nockenwellenexenter für Kraftstofförderpumpe auf UT stellen.

118. Kraftstofförderpumpe anbauen. Schrauben wechselseitig bis zur Anlage einschrauben.

119. Schrauben festdrehen.

Anziehvorschrift: **21 Nm**

4

English

Fuel feed pump/fuel filter

116. Position new O-seal.

117. Set camshaft eccentric for fuel feed pump to BDC.

118. Mount fuel feed pump. Screw in bolts alternately as far as they will go.

119. Tighten bolts.

Tightening specification: **21 Nm**

Français

Pompe d'alimentation/filtre à combustible

116. Placer un joint torique neuf.

117. Régler excentrique de l'arbre à cames pour pompe d'alimentation sur PMB.

118. Monter pompe d'alimentation. Visser alternativement les vis jusqu'en position de butée.

119. Serrer les vis.

Consigne de serrage: **21 Nm**

Español

Bomba de alimentación de combustible/filtro de combustible

116. Colocar un anillo tórico nuevo.

117. Poner la excéntrica del árbol de levas para la bomba de alimentación de combustible en PMI.

118. Montar la bomba de alimentación de combustible. Enroscar alternando los tornillos hasta que se asienten.

119. Apretar los tornillos.

Prescripción de apriete: **21 Nm**

English

120. Screw in plug for oil filler neck.

121. Fit fuel filter bracket. Tighten bolts.

Tightening specification: **21 Nm**

122. Lightly oil fuel filter gasket. Secure fuel filter cartridge fingertight.

123. Mount fuel lines.

Note: Use Cobra clamp pliers.

Français

120. Visser bouchon obturateur de jauge d'huile.

121. Monter console de filtre à combustible. Serrer les vis.

Consigne de serrage: **21 Nm**

122. Huiler légèrement joint de filtre à combustible. Serrer à la main cartouche de filtre à combustible.

123. Monter conduites d'alimentation.

Nota: utiliser pince à ressorts Cobra pour tuyaux.

Español

120. Enroscar la tapa de cierre en la boca de llenado de aceite.

121. Montar la consola para el filtro de combustible. Apretar los tornillos.

Prescripción de apriete: **21 Nm**

122. Untar con un poco de aceite la junta del filtro de combustible. Apretar a mano el cartucho del filtro de combustible.

123. Montar las tuberías de combustible.

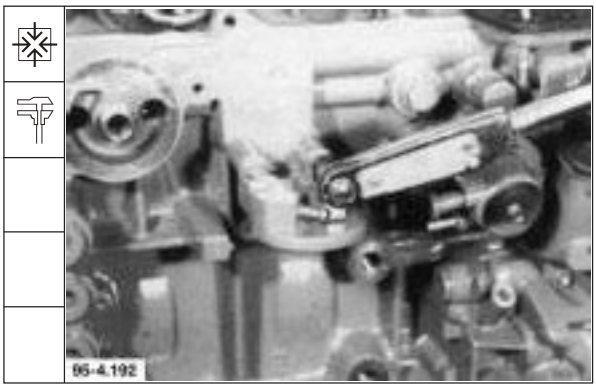
Nota: Usar los alicates Cobra para abrazaderas.

Deutsch

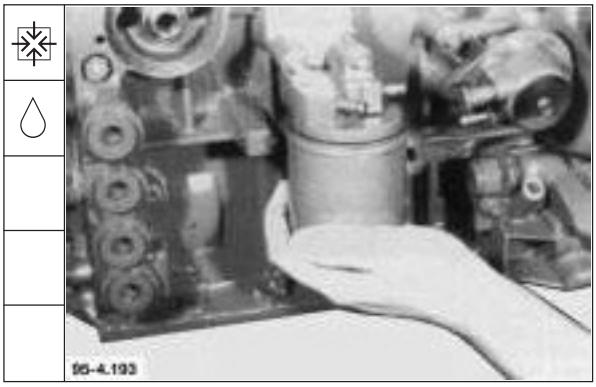
120. Verschlußdeckel für Öleinfüllung einschrauben.

121. Kraftstoffilterkonsole anbauen. Schrauben festdrehen.

Anziehvorschrift: **21 Nm**

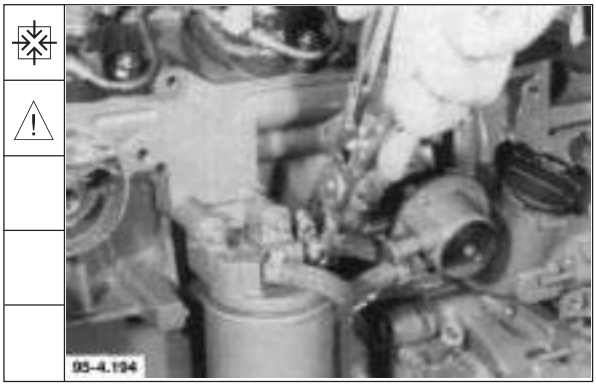


122. Kraftstoffilterdichtung leicht einölen. Kraftstoffilterpatrone handfest andrehen.



123. Kraftstoffleitungen anbauen.

Hinweis: Cobraklemmenzange benutzen.



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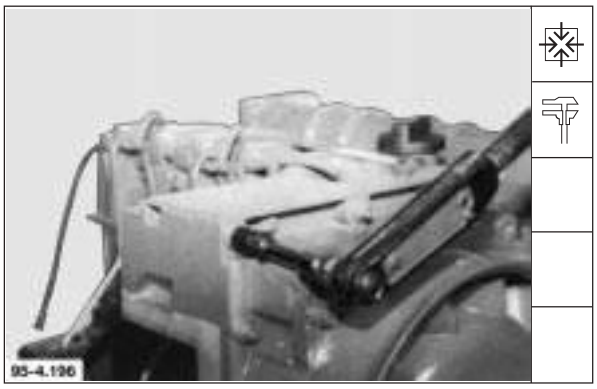
Deutsch

124. Ölfilterdichtung leicht einölen. Filterpatrone handfest andrehen.

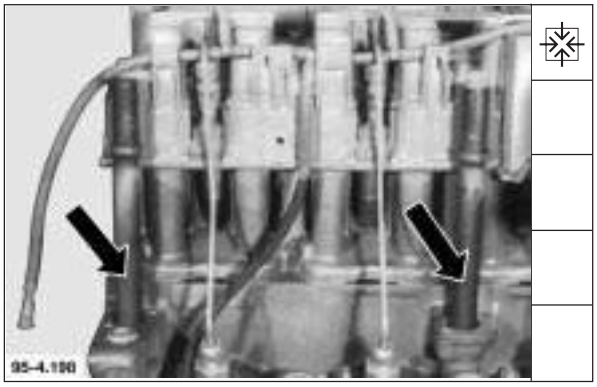


Luftführung / Ölkühler

125. Luftführung anbauen. Schrauben festdrehen.

Anziehvorschrift: **21 Nm**

126. Steckstücke auf sichtbare Beschädigungen prüfen.



127. Steckstücke bis Anlage eindrücken.

English

124. Lightly oil oil filter gasket. Secure oil filter cartridge fingertight.

Air ducting/oil cooler

125. Mount air ducting. Tighten bolts.

Tightening specification: **21 Nm**

126. Inspect plug-in elements for visual damage.

127. Press in plug-in elements as far as they will go.

Français

124 Huiler légèrement joint de filtre à huile. Bien serrer à la main cartouche du filtre.

Gaine de guidage d'air/radiateur à huile

125. Monter le guidage d'air. Serrer les vis.

Consigne de serrage: **21 Nm**

126. Vérifier que les pièces insérées ne présentent pas de dommages visibles.

127. Enfoncer les pièces insérées jusqu'en position de butée.

Español

124. Untar con un poco de aceite la junta del filtro de aceite. Apretar a mano el cartucho filtrante.

Conducción de aire/refrigerador de aceite

125. Montar la conducción de aire. Apretar los tornillos.

Prescripción de apriete: **21 Nm**

126. Examinar las piezas de enchufe en cuanto a daños visibles.

127. Introducir a presión, hasta el tope, las piezas de enchufe.

English

With B/FM engines:

127.1 Fit new O-seals to oil cooler connections to that spot facing points towards crankcase. See illustration.
Fit oil cooler connections.
Tighten bolts.

Tightening specification: **13 Nm**

128. Position oil cooler.

129. Fit stay plate. Tighten bolts.

Tightening specification: **21 Nm**

130. Tighten oil cooler fastening bolts.

Tightening specification. **21 Nm**

Français

Moteurs B/FM

127.1 Monter joints neufs sur les raccords du radiateur à huile de manière à ce que le chanfrein soit orienté vers le bloc moteur. Voir figure en coupe.
Monter les raccords du radiateur. Serrer les vis.

Consigne de serrage: **13 Nm**

128. Placer le radiateur.

129. Monter tôle verticale et serrer les vis.

Consigne de serrage: **21 Nm**

130. Serrer les vis de fixation du radiateur.

Consigne de serrage: **21 Nm**

Español

En los motores B/FM:

127.1 Colocar las juntas anulares nuevas sobre los racores del refrigerador de aceite, de modo que el rebaje indique hacia el bloque motor. Ver el detalle.
Montar los racores para el refrigerador de aceite. Apretar los tornillos.

Prescripción de apriete: **13 Nm**

128. Colocar el refrigerador de aceite en su sitio.

129. Montar la chapa vertical. Apretar los tornillos.

Prescripción de apriete: **21 Nm**

130. Apretar los tornillos que fijan el refrigerador de aceite.

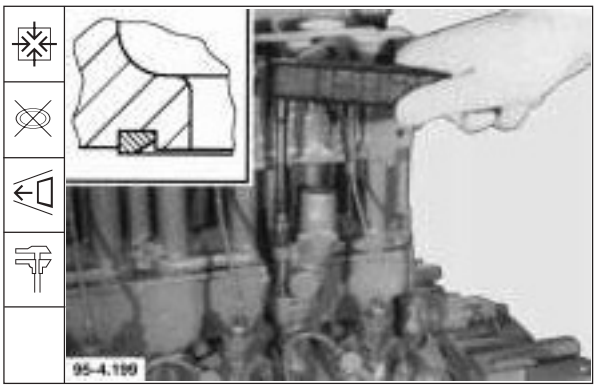
Prescripción de apriete: **21 Nm**

Deutsch

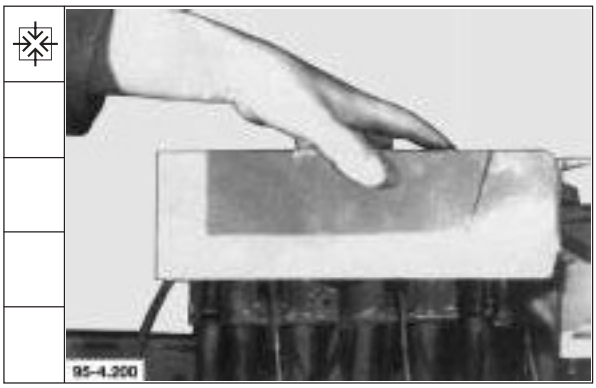
Bei B/FM - Motoren.

127.1 Neue Dichtringe so auf die Ölkühleranschlüsse montieren, daß die Ansenkung zum Kurbelgehäuse weist. Siehe Bildausschnitt.
Ölkühleranschlüsse anbauen. Schrauben festdrehen.

Anziehvorschrift: **13 Nm**



128. Ölkühler aufsetzen.

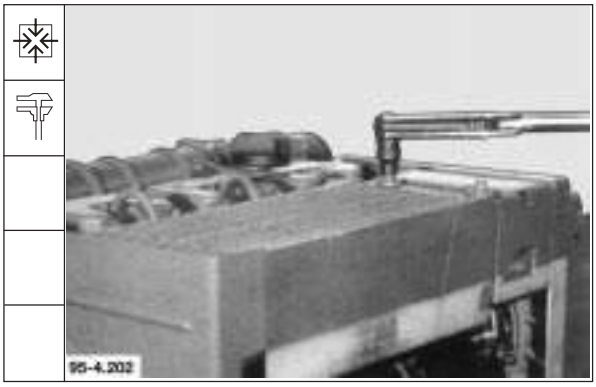


129. Standblech anbauen. Schrauben festdrehen.

Anziehvorschrift: **21 Nm**

130. Ölkühlerbefestigungsschrauben festdrehen.

Anziehvorschrift: **21 Nm**



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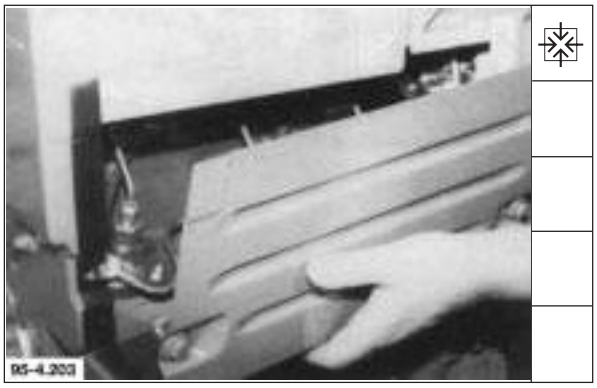
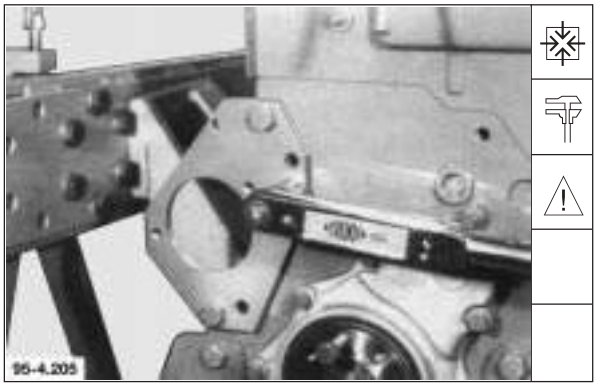


131. Luftführungshaube anbauen. Schrauben festdrehen.

132. Aufstellfüße / Halter anbauen. Schrauben festdrehen.

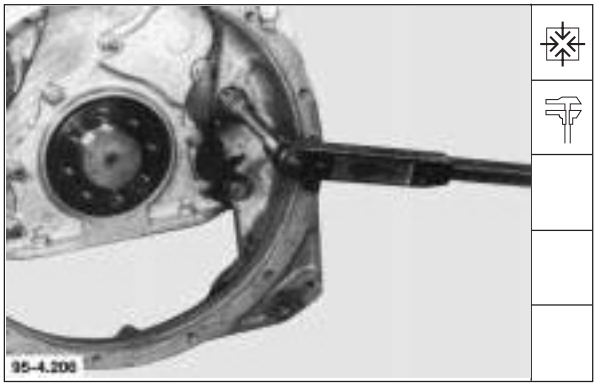
Anziehvorschrift:
Vorspannwert **106 Nm**
Nachspannwinkel **30°**



133. Konsole für Starter anbauen. Schrauben festdrehen.

Anziehvorschrift: **75 ± 7 Nm**

Hinweis: Auf vorhandensein der Zentrierhülsen achten.



134. Falls vorhanden, Anschlußgehäuse anbauen. Schrauben festdrehen.

Anziehvorschrift:
Schrauben M 12 **106 Nm**
Schrauben M 14 **180 Nm**

English

131. Mount air cowling. Tighten bolts.

132. Fit mounting feet/retainer. Tighten bolts.

Tightening specification:
Initial tightening torque **106 Nm**
Tightening angle **30°**

133. Mount starter bracket. Tighten bolts.

Tightening specification: **75 ±7 Nm**

Note: Make sure that centering sleeves are installed.

134. Mount adapter housing, if any. Tighten bolts.

Tightening specifiation:
bolts M 12 **106 Nm**
bolts M 14 **180 Nm**

Français

131. Monter hotte de guidage d'air. Serrer les vis.

132 Monter pieds de fixation / support. Serrer les vis.

Consigne de serrage:
Valeur de préserrage **106 Nm**
Serrage à l'angle **30°**

133. Monter console du démarreur. Serrer les vis.

Consigne de serrage: **75 ± 7 Nm**

Nota: veiller à la présence des douilles de centrage.

134. Monter carter d'adaptation si le moteur en a un. Serrer les vis.

Consigne de serrage:
Vis M 12 **106 Nm**
Vis M 14 **180 Nm**

Español

131. Montar la manga guía de aire. Apretar los tornillos.

132. Montar las patas de colocación / los soportes. Apretar los tornillos.

Prescripción de apriete:
Apriete inicial **106 Nm**
Angulo de reapriete **30°**

133. Montar la consola para el arrancador. Apretar los tornillos.

Prescripción de apriete: **75 ± 7 Nm**

Nota: Prestar atención a que existan los casquillos de centraje.

134. Si existe, montar el cárter de adaptación. Apretar los tornillos.

Prescripción de apriete:
tornillos M 12 **106 Nm**
tornillos M 14 **180 Nm**

English

135. Position flywheel, using a self-made pilot bar.

Note: Use new bolts.

136. Retain flywheel. Tighten bolts.

Tightening specification:	
Initial tightening torque	**30 Nm**
Tightening angle	**60°**
Tightening angle	**30°**

Hydraulic pump bracket

137. Insert new O-seals.

138. Mount hydraulic pump bracket. Start fastening bolts.

Français

135. Mettre en place le volant moteur en utilisant un mandrin de guidage de fabrication locale.

Nota: utiliser des vis neuves.

136. Maintenir le volant moteur et serrer les vis.

Consigne de serrage:	
Valeur de préserrage:	**30 Nm**
Serrage à l'angle:	**60°**
Serrage à l'angle:	**30°**

Console de pompe hydraulique

137. Placer des joints toriques neufs.

138. Monter console de pompe hydraulique. Serrer légèrement vis de fixation.

Español

135. Montar el volante, utilizando un mandril de guía de confección propia.

Nota: Usar tornillos nuevos.

136. Retener el volante. Apretar los tornillos.

Prescripción de apriete:	
Apriete inicial:	**30 Nm**
Angulo de reapriete:	**60°**
Angulo de reapriete:	**30°**

Soporte de la bomba hidráulica

137. Introducir anillos tóricos nuevos.

138. Montar el soporte de la bomba hidráulica. Apretar ligeramente los tornillos de fijación.

Deutsch

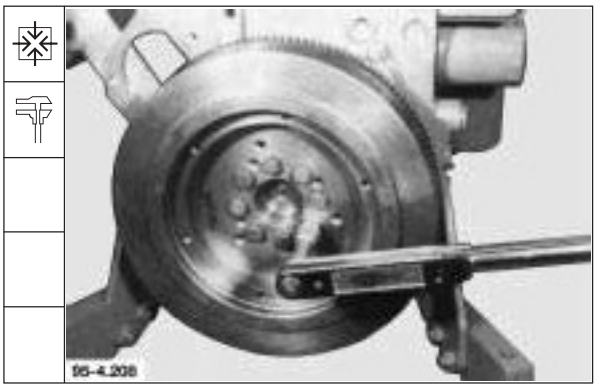
135. Schwungrad unter Verwendung eines selbstgefertigten Führungsdornes aufsetzen.

Hinweis: Neue Schrauben verwenden.

136. Schwungrad gegenhalten. Schrauben festdrehen.

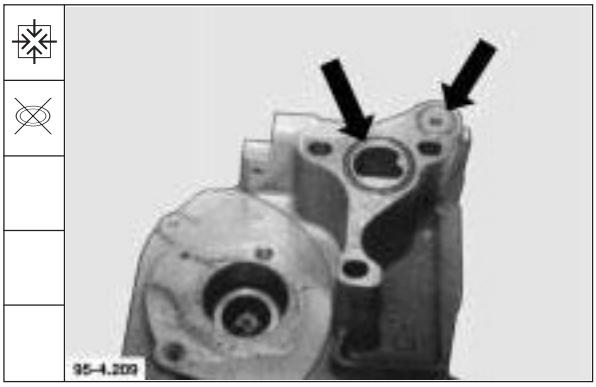
Anziehvorschrift:

Vorspannwert:	**30 Nm**
Nachspannwinkel:	**60°**
Nachspannwinkel:	**30°**

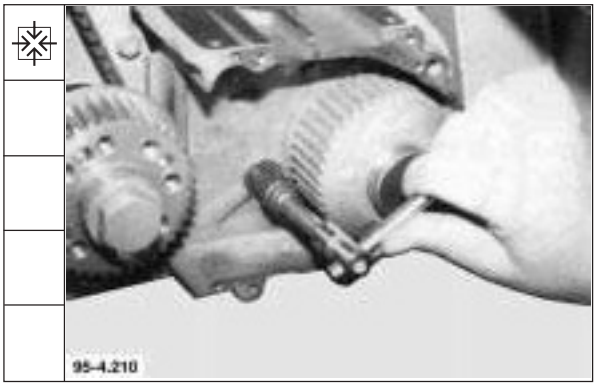


Hydraulikpumpenkonsole

137. Neue Runddichtringe einsetzen.



138. Hydraulikpumpenkonsole anbauen. Befestigungsschrauben leicht andrehen.



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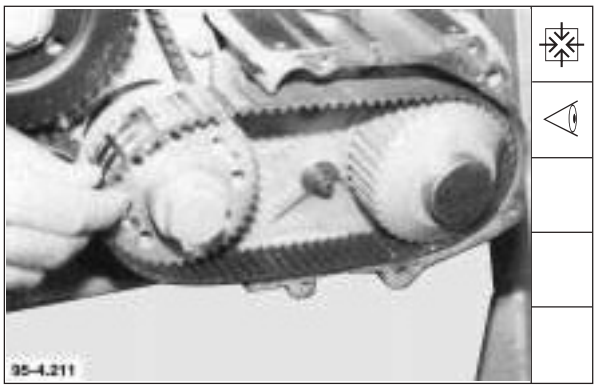
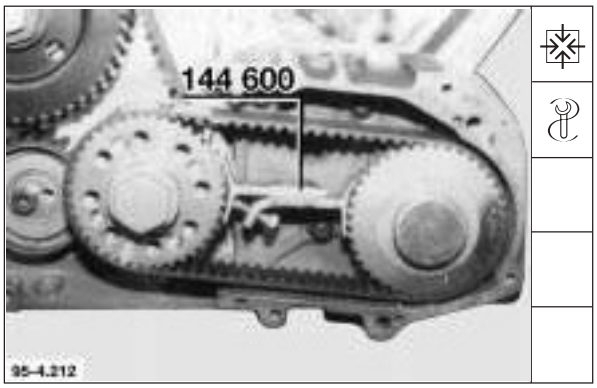
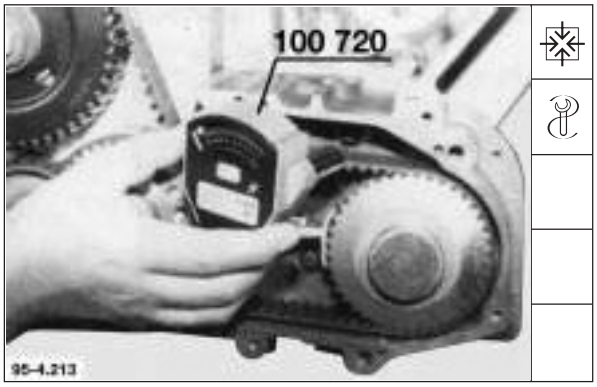


139. Zahnriemen aufsetzen.
Auf dem Kurbelwellenzahnrad bis gegen den hinteren Führungsbord und auf dem Hydraulikpumpenzahnrad mit ca. 4 mm Rückstand zur Vorderkante.



140. Spannvorrichtung ansetzen.



141. Zahnriemenspannungs-Meßgerät aufsetzen.

142. Zahnriemen über die Spannvorrichtung vorspannen, so daß ein Skalenwert von **10,5 bis 11,5** erreicht wird.
Spannungs-Meßgerät entfernen.

English

139. Position toothed belt.
On crankshaft gear as far as rear guide plate and on hydraulic pump gear with approx. 4 mm distance from front edge.

140. Position tensioning device.

141. Position toothed belt tension gauge.

142. Tension toothed belt with tensioning device so as to attain a scale reading between **10.5 and 11.5**.
Remove tension gauge.

Français

139. Mettre en place la courroie crantée.
Sur le pignon du vilebrequin jusqu'au bord de guidage arrière et sur le pignon de la pompe hydraulique retrait d'environ 4 mm par rapport à l'arête avant.

140. Mettre en place le dispositif tendeur.

141. Mettre en place l'appareil de vérification de la tension de la courroie crantée.

142. Avec le dispositif tendeur tendre la courroie crantée jusqu'à obtention sur l'échelle d'une valeur de **10,5 à 11,5.**
Enlever l'appareil de vérification de la tension.

Español

139. Colocar la correa dentada.
Sobre la rueda dentada del cigüeñal hasta contra el borde trasero de guía y sobre la rueda dentada de la bomba hidráulica con un retroceso de aprox. 4 mm con respecto al canto delantero.

140. Colocar el tensor.

141. Colocar el verificador de tensión para correas dentadas.

142. Pretensar la correa dentada mediante el tensor hasta que se alcance un valor de **10,5 a 11,5** en la escala.
Retirar el verificador de tensión.

English

143. Tighten fastening bolts of bracket.

    Tightening specification: **57 Nm**

144. Remove tensioning device.
    Turn crankshaft **one** revolution in direction of engine rotation.

145. Position toothed belt tension gauge.
    Gauge belt tension.

    Specified scale reading:
    10 to 12

146. If the specified scale reading is not attained, repeat procedure.

Français

143. Serrer les vis de fixation de la console.

    Consigne de serrage: **57 Nm**

144. Oter le dispositif tendeur.
Virer le vilebrequin **d'un** tour dans le sens de rotation du moteur.

145. Placer l'appareil de vérification de la tension de courroie crantée.
    Mesurer la tension.

    Valeur de consigne sur l'échelle
    10 à 12

146. Si la valeur de consigne indiquée sur l'échelle graduée n'est pas atteinte, répéter le réglage.

Español

143. Apretar los tornillos de fijación del soporte.

    Prescripción de apriete: **57 Nm**

144. Quitar el tensor.
    Darle al cigüeñal **1** vuelta en el sentido de giro normal del motor.

145. Colocar el verificador de tensión para correas dentadas. Medir la tensión de la correa.

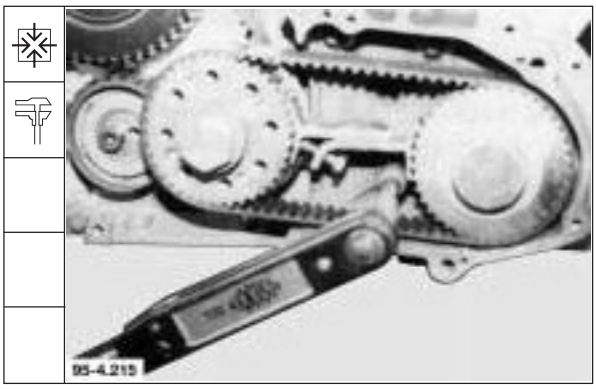
    Valor prescrito: valor de escala
    10 a 12

146. Al no alcanzarse el valor de escala exigida, hay que repetir la operación de ajuste.

Deutsch

143. Befestigungsschrauben der Konsole festdrehen.

Anziehvorschrift: **57 Nm**

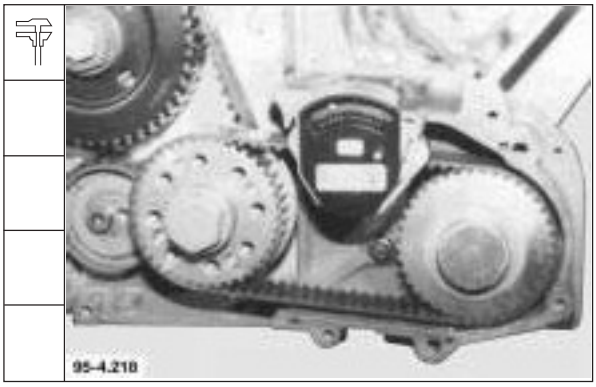


144. Spannvorrichtung entfernen.
Kurbelwelle **1** Umdrehung in Motordrehrichtung drehen.

145. Zahnriemenspannungs-Meßgerät aufsetzen. Riemenspannung messen.

Sollwert: Skalenwert **10 bis 12**

146. Wenn der geforderte Skalenwert nicht erreicht wird, ist die Einstellung zu wiederholen.



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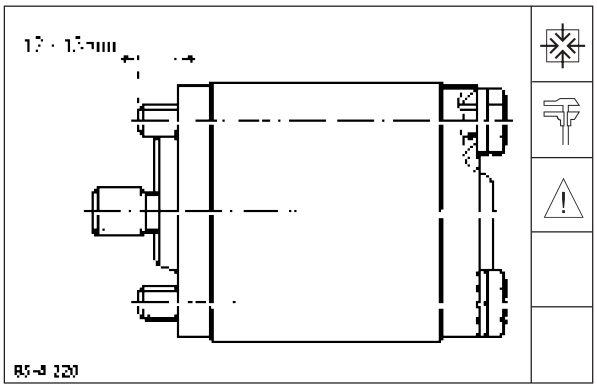
Deutsch

Hydraulikpumpe

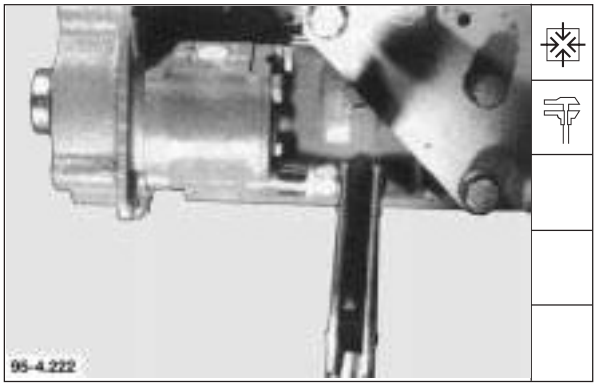
147. Zahnwelle mit Graphitfett bestreichen. Kupplungshülse aufschieben.



148. Befestigungsschrauben mit Scheiben einsetzen. Vorstehmaß der Schrauben messen.

Hinweis: Das max. Vorstehmaß von **15 mm** darf nicht überschritten werden.

149. Zahnwelle der Hydraulikpumpenkonsole mit Graphitfett bestreichen. Hydraulikpumpe anbauen.



150. Schrauben festdrehen.

Anziehvorschrift: **57 Nm**

English

Hydraulic pump

147. Apply graphite grease to toothed shaft. Slide on coupling sleeve.

148. Insert fastening bolts together with washers. Measure bolt projection.

Note: The max. projection of **15 mm** must not be exceeded.

149. Apply graphite grease to toothed shaft of hydraulic pump bracket. Mount hydraulic pump.

150. Tighten bolts.

Tightening specification: **57 Nm**

Français

Pompe hydraulique

147. Enduire arbre-pignon de graisse au graphite. Insérer douille d'accouplement.

148. Placer les vis de fixation avec les rondelles. Mesurer la cote de dépassement des vis.

Nota: la cote de dépassement maxi ne doit pas dépasser **15 mm**.

149. Enduite l'arbre-pignon de la console de la pompe hydraulique de graisse au graphite puis monter la pompe hydraulique.

150. Serrer les vis.

Consigne de serrage: **57 Nm**

Español

Bomba hidráulica

147. Aplicar grasa grafitada al eje dentado. Colocar sobre el eje el manguito de acoplamiento.

148. Meter los tornillos de fijación con sus arandelas. Medir la medida que sobresalen.

Nota: Esta medida no debe ser superior a **15 mm**.

149. Aplicar grasa grafitada al eje dentado del soporte de la bomba hidráulica. Montar la bomba hidráulica.

150. Apretar los tornillos.

Prescripción de apriete: **57 Nm**

English

151. Position intermediate disc with flattened side facing the engine.

152. Mount toothed belt guard.

153. Tighten bolts.

Tightening specification. **8.5 Nm**

154. Fit V-belt pulley. Tighten bolts.

Tightening specification: **42 ± 4 Nm**

Français

151. Placer la rondelle intermédiaire en orientant le côté plat vers le moteur.

152. Monter le carter cache-courroie.

153. Serrer les vis.

Consigne de serrage: **8,5 Nm**

154. Monter la courroie à gorge et serrer les vis.

Consigne de serrage: **42 ± 4 Nm**

Español

151. Colocar la arandela intermedia con la cara aplanada indicando hacia el motor.

152. Montar la cubierta protectora de correas dentadas.

153. Apretar los tornillos.

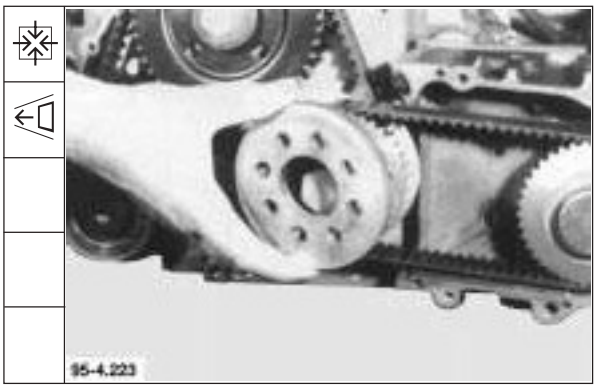
Prescripción de apriete: **8,5 Nm**

154. Montar la polea de correa trapezoidal. Apretar los tornillos.

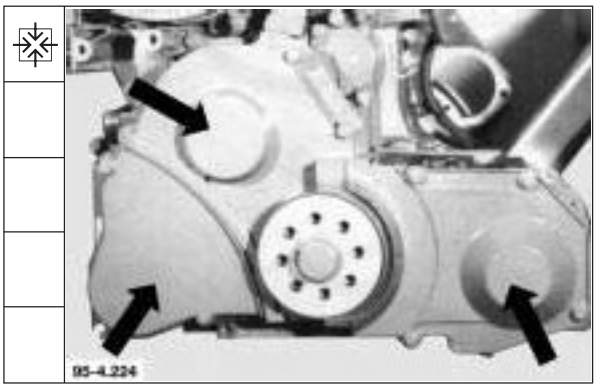
Prescripción de apriete: **42 ± 4 Nm**

Deutsch

151. Zwischenscheibe mit der abgeflachten Seite zum Motor weisend aufsetzen.

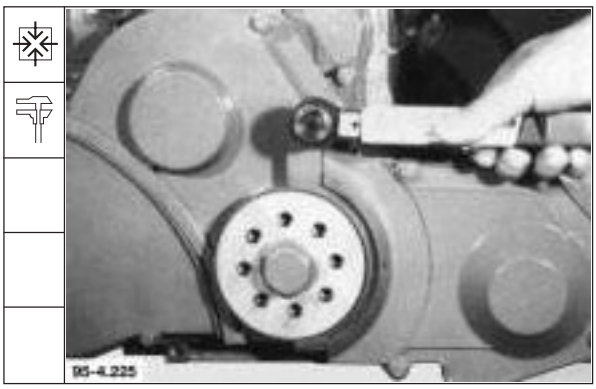


152. Zahnriemenschutzgehäuse anbauen.



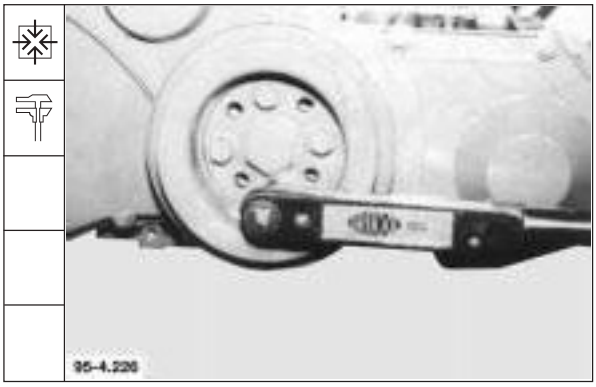
153. Schrauben festdrehen.

Anziehvorschrift: **8,5 Nm**



154. Keilriemenscheibe anbauen. Schrauben festdrehen.

Anziehvorschrift: **42 ± 4 Nm**



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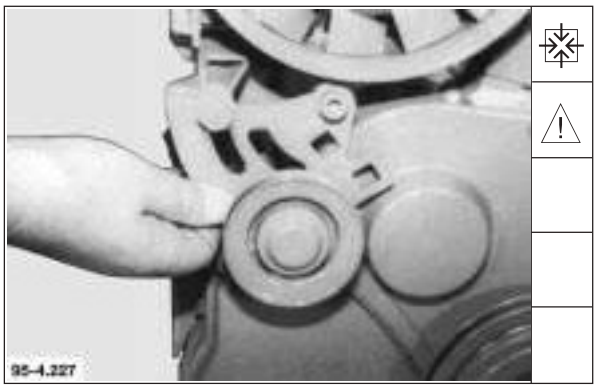
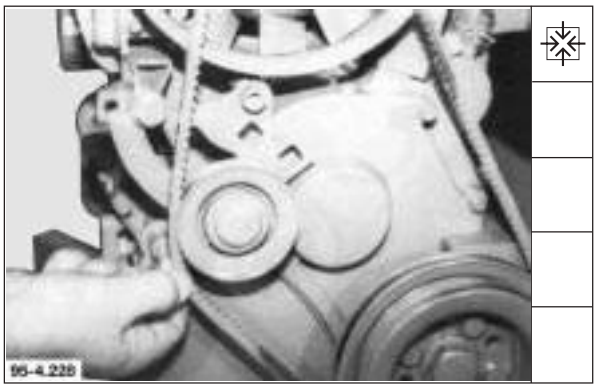
Deutsch

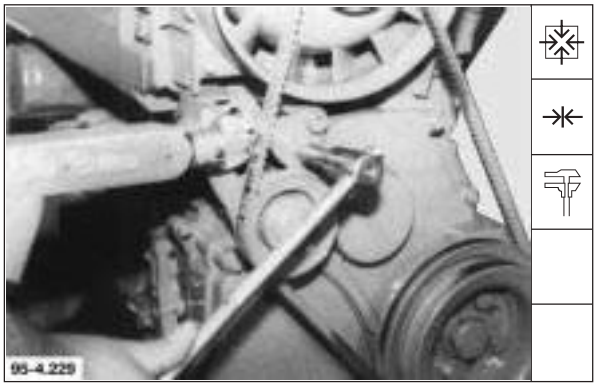


155. Keilriemenspannrolle anbauen.

Hinweis: Schrauben leicht festdrehen.

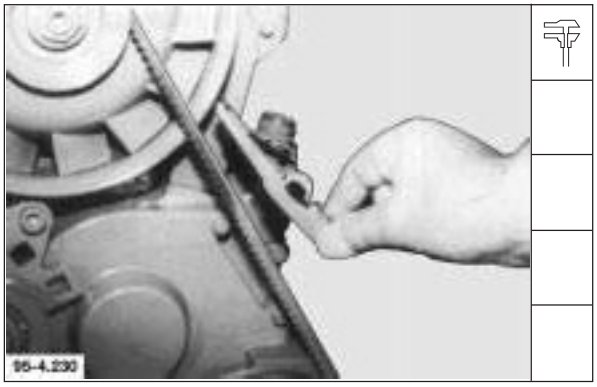


156. Keilriemen auflegen.



157. Keilriemen spannen. Schrauben festdrehen.

Anziehvorschrift: **45 Nm**



158. Keilriemenspannung mit Spannungsmeßgerät prüfen.

Erstmontage:	**400 ± 20 N**
Kontrollwert nach 15 Minuten Lauf unter Last:	**300 ± 20 N**

4

English

155. Fit V-belt idler pulley.

Note: Start bolts.

156. Position V-belt.

157. Tension V-belt. Tighten bolts.

Tightening specification: **45 Nm**

158. Check V-belt tension with tension gauge.

Initial assembly: **400 ± 20 N**
Check value after 15 min. operation under load: **300 ± 20 N**

Français

155. Monter galet tendeur de courroie.

Nota: serrer légèrement les vis.

156. Placer la courroie.

157. Tendre la courroie et serrer les vis.

Consigne de serrage: **45 Nm**

158. A l'aide de l'appareil de mesure vérifier la tension de courroie.

Premier montage: **400 ± 20 N**
Valeur de contrôle après une marche de 15 minutes sous charge: **300 ± 20 N**

Español

155. Montar la polea tensora de la correa trapezoidal.

Nota: Apretar ligeramente los tornillos.

156. Colocar la correa trapezoidal.

157. Tensar la correa trapezoidal. Apretar los tornillos.

Prescripción de apriete: **45 Nm**

158. Comprobar la tensión de la correa trapezoidal utilizando el verificador de tensión correspondiente.

Primer montaje: **400 ± 20 N**
Valor de control tras marcha de 15 minutos bajo carga: **300 ± 20 N**

English

Air compressor

159. Insert new O-seal using some grease.

160. Position air compressor and press down as far as it will go in direction of arrow.

161. Tighten bolts.

Tightening specification: **21 Nm**

162. Mount lube oil pipe together with new Cu seals. Tighten bolts.

Tightening specification: **18 Nm**

Français

Compresseur d'air

159. Placer un joint torique neuf avec un peu de graisse.

160. Monter le compresseur et enfoncer jusqu'en position d'appui dans le sens de la flèche.

161. Serrer les vis.

Consigne de serrage: **21 Nm**

162. Monter tuyauterie d'huile avec des bagues en Cu neuves. Serrer les vis.

Consigne de serrage: **18 Nm**

Español

Compresor de aire

159. Colocar el anillo tórico nuevo con un poco de grasa.

160. Montar el compresor de aire y presionarlo en dirección de la flecha hasta que se asiente.

161. Apretar los tornillos.

Prescripción de apriete: **21 Nm**

162. Montar la tubería de aceite lubricante con anillos nuevos de cobre. Apretar los tornillos.

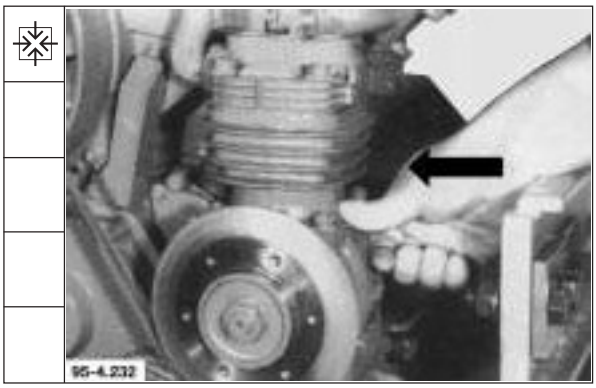
Prescripción de apriete: **18 Nm**

Deutsch

Luftpresser

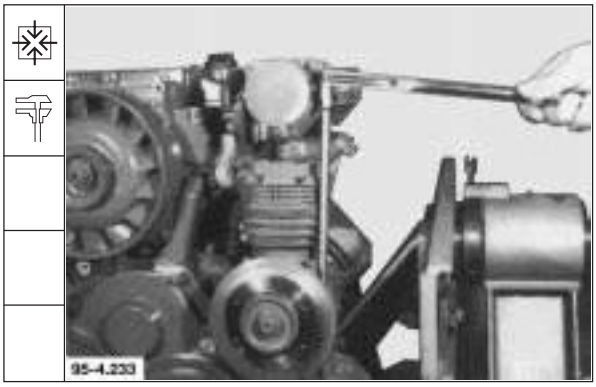
159. Neuen Runddichtring mit etwas Fett einsetzen.

160. Luftpresser aufbauen und in Pfeilrichtung auf Anlage drücken.



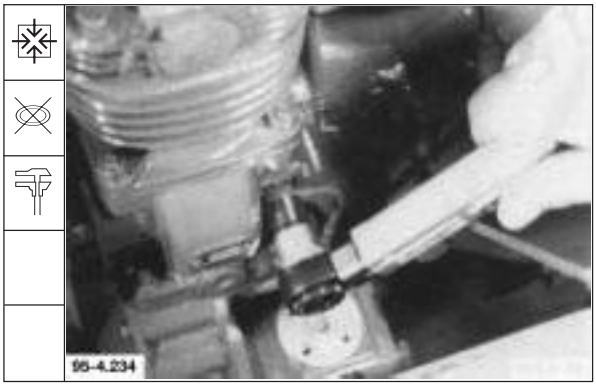
161. Schrauben festdrehen.

Anziehvorschrift: **21 Nm**



162. Schmierölleitung mit neuen Cu-Ringen anbauen. Schrauben festdrehen.

Anziehvorschrift: **18 Nm**



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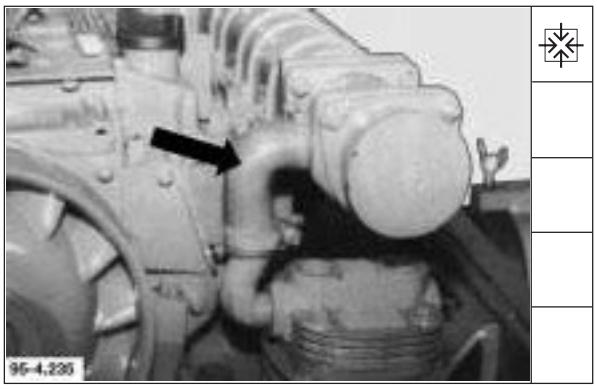
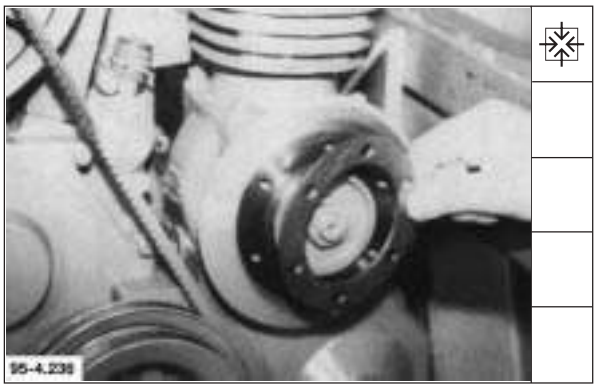
Deutsch

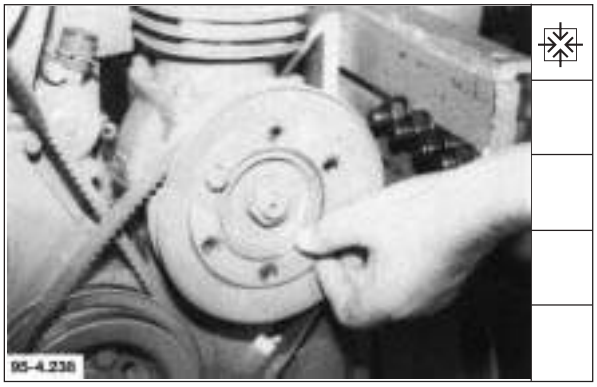


163. Schlauchkrümmer anbauen. Schlauchschellen festdrehen.



164. Herausgenommene Ausgleichscheiben beilegen.

165. Keilriemen und äußere Keilriemenscheibe montieren.



166. Falls vorhanden, restliche Ausgleichscheiben aufsetzen. Schrauben einschrauben.

English	Français	Español
163. Fit hose elbow. Secure hose clips.	163. Monter tubulure flexible et serrer colliers de fixation.	163. Montar el codo de manguera. Apretar las abrazaderas de manguera.
164. Place back removed shims.	164. Intercaler cales de compensation retirées.	164. Colocar las arandelas de compensación que se haya desmontado.
165. Fit V-belt and outer V-belt pulley.	165. Monter courroie trapézoïdale et poulie à gorge extérieure.	165. Colocar la correa trapezoidal y la polea exterior.
166. Position remaining shims, if provided. Screw in bolts.	166. Placer le cas échéant les cales de compensation restantes. Serrer les vis.	166. Si existen, colocar las arandelas de compensación restantes. Enroscar los tornillos.

English

167. Tighten bolts while continuously turning the engine.

Tightening specification: **19 Nm**

168. Check V-belt tension.
If specified scale reading is not attained, repeat procedure.

V-belt tension:
Initial assembly: **500 + 50 N**
Check value after 15 min. operation under load **410 + 50 N**

Note: Turn engine by 180°.

Oil suction pipe

169. Apply sealing compound DEUTZ **DW 67** to sealing surface of oil suction pipe.

Note: Make sure that no sealing compound penetrates into the oil suction pipe.

170. Mount oil suction pipe. Tighten bolts.

Tightening specification: **22 Nm**

Français

167. Serrer les vis tout en virant constamment le moteur.

Consigne de serrage: **19 Nm**

168. Vérifier la tension de courroie.
Si la valeur de consigne n'est pas atteinte, répéter l'opération de tension.

Tension de courroie:
première monte **500 + 50 N**
Valeur de contrôle après une marche de 15 minutes sous charge: **410 + 50 N**

Nota: virer le moteur de 180°.

Tube d'aspiration d'huile

169. Enduire de pâte d'étanchéité DEUTZ **DW 67** le plan de joint du tube d'aspiration d'huile.

Nota: veiller à ce que le produit d'étanchéité ne coule pas dans le tube d'aspiration.

170. Monter le tube d'aspiration. Serrer les vis.

Consigne de serrage: **22 Nm**

Español

167. Girando constantemente el cigüeñal, apretar los tornillos.

Prescripción de apriete: **19 Nm**

168. Verificar la tensión de la correa trapezoidal.
Al no alcanzarse el valor prescrito, es necesario repetir la operación de tensado.

Tensión de correa trapezoidal:
Primer montaje: **500 + 50 N**
Valor de control tras marcha de 15 minutos bajo carga: **410 + 50 N**

Nota: Girar el motor 180°.

Tubo de aspiración de aceite

169. Aplicar sellante DEUTZ **DW 67** a la superficie de cierre del tubo de aspiración de aceite.

Nota: No debe llegar ningún sellante al interior del tubo de aspiración de aceite.

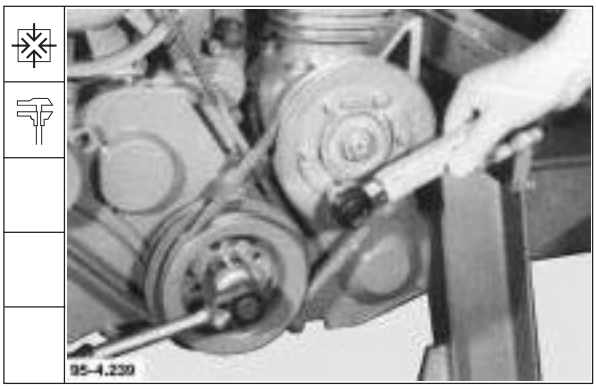
170. Montar el tubo de aspiración de aceite. Apretar los tornillos.

Prescripción de apriete: **22 Nm**

Deutsch

167. Schrauben unter ständigem Durchdrehen des Motors festdrehen.

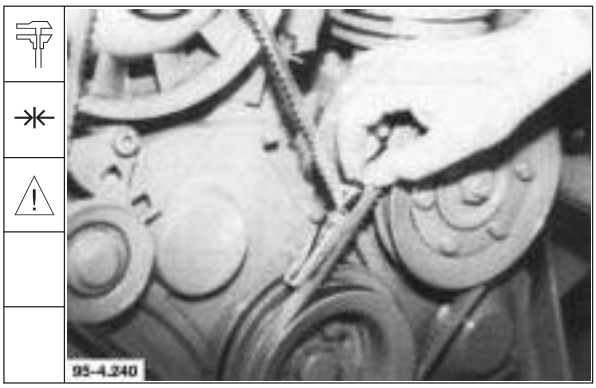
Anziehvorschrift: **19 Nm**



168. Keilriemenspannung prüfen.
Wenn der Sollwert nicht erreicht wird, Spannvorgang wiederholen.

Keilriemenspannung:
Erstmontage: **500 + 50 N**
Kontrollwert nach
15 Minuten Lauf unter Last: **410 + 50 N**

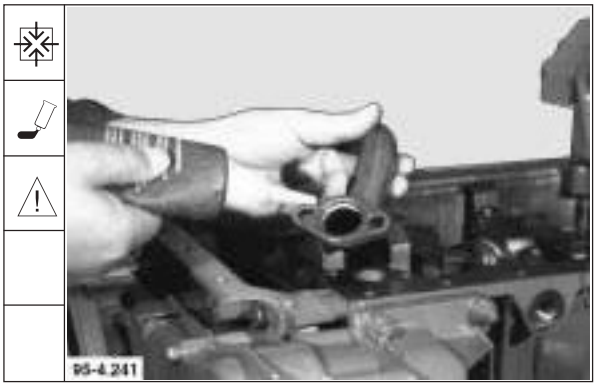
Hinweis: Motor um 180° drehen.



Ölansaugrohr

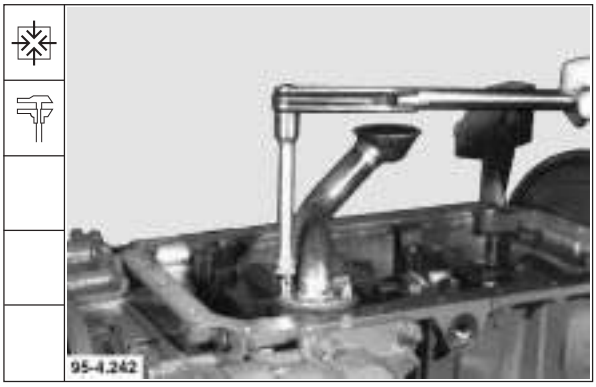
169. Dichfläche des Ölansaugrohres mit Dichtmittel DEUTZ **DW 67** bestreichen.

Hinweis: Darauf achten, daß kein Dichtmittel in das Ölansaugrohr fließt.



170. Ölansaugrohr anbauen. Schrauben festdrehen.

Anziehvorschrift: **22 Nm**



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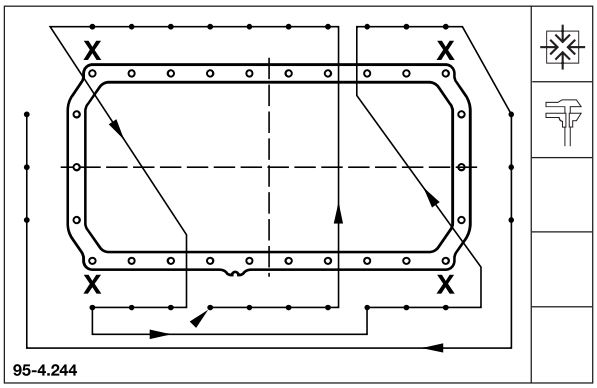
Deutsch

171. Dichfläche der Ölwanne mit Dichtmittel DEUTZ **DW 47** bestreichen. Ölwanne anbauen. Eckschrauben „X“ jeweils mit **0,5 Nm** vorspannen. Alle Schrauben nach Anziehreihenfolge, siehe Skizzen, festdrehen.

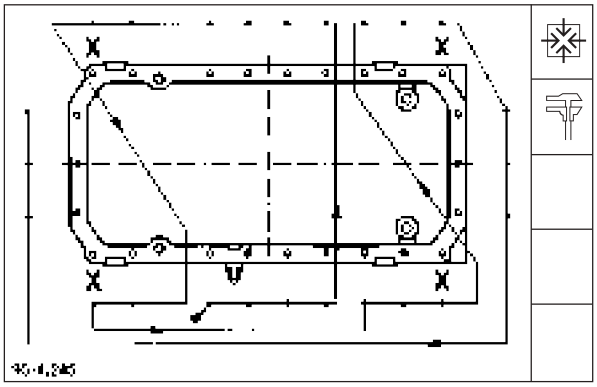


171.1 4-Zylinder

Anziehvorschrift:

Blechölwanne
Schrauben M 8 x 16 mm -8.8 **21 Nm**

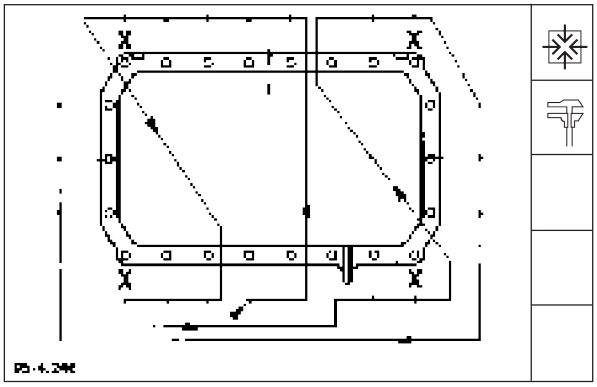
Gußölwanne
Schrauben M 8 x 30 mm -10.9 **31 Nm**
Schrauben M 8 x 55 mm -10.9 **21 Nm**



171.2 4-Zylinder

Anziehvorschrift:

Gußölwanne
Schrauben M 8 x 30 mm -8.8 **21 Nm**
Schrauben M 8 x 55 mm -10.9 **21 Nm**
Zylinderkopfschrauben **180 Nm**



171.3 3-Zylinder

Anziehvorschrift:

Blechölwanne
Schrauben M 8 x 16 mm -8.8 **21 Nm**

English

171. Apply sealing compound DEUTZ **DW 47** to sealing surface of oil pan. Mount oil pan. Initially tighten corner bolts „X“ with **0.5 Nm** each. Tighten all bolts according to tightening order, see sketches below.

171.1 4-Cylinder

Tightening specification:

Sheet metal oil pan	
Bolts	
M 8 x 16 mm -8.8	**21 Nm**
Cast oil pan	
Bolts	
M 8 x 30 mm -10.9	**31 Nm**
Bolts	
M 8 x 55 mm -10.9	**21 Nm**

171.2 4-Cylinder

Tightening specification:

Cast oil pan	
Bolts	
M 8 x 30 mm -8.8	**21 Nm**
Bolts	
M 8 x 55 mm -10.9	**21 Nm**
Cylinder head bolts	**180 Nm**

171.3 3-Cylinder

Tightening specification:

Sheet metal oil pan	
Bolts	
M 8 x 16 mm -8.8	**21 Nm**

Français

171. Enduire le plan d’appui du carter d’huile de pâte d’étanchéité DEUTZ **DW 47.** Monter le carter d’huile. Préserrer les vis „X“ situées dans le coins d’une valeur respective correspondant à **0,5 Nm**. Ensuite bloquer toutes les vis selon les préconisations de serrage, voir croquis.

171.1 4 cylindres

Consigne de serrage

Carter d’huile en tôle	
Vis	
M 8 x 16 mm -8.8	**21 Nm**
Carter d’huile en fonte	
Vis	
M 8 x 30 mm -10.9	**31 Nm**
Vis	
M 8 x 55 mm -10.9	**21 Nm**

171.2 4 cylindres

Consigne de serrage

Carter d’huile en fonte	
Vis	
M 8 x 30 mm -8.8	**21 Nm**
Vis	
M 8 x 55 mm -10.9	**21 Nm**
Vis de culasse	**180 Nm**

171.3 3 cylindres

Consigne de serrage

Carter d’huile en tôle	
Vis	
M 8 x 16 mm -8.8	**21 Nm**

Español

171. Aplicar sellante DEUTZ **DW 47** a la superficie de cierre del cárter de aceite. Montar el cárter de aceite. Apretar cada uno de los tornillos de esquina con un par previo de **0,5 Nm**. Apretar todos los tornillos según el orden de sucesión correspondiente, ver los croquis.

171.1 4 cilindros

Prescripción de apriete:

Cárter de aceite, de chapa	
Tornillos	
M 8 x 16 mm -8.8	**21 Nm**
Cárter de aceite, de fundición	
Tornillos	
M 8 x 30 mm -10.9	**31 Nm**
Tornillos	
M 8 x 55 mm -10.9	**21 Nm**

171.2 4 cilindros

Prescripción de apriete:

Cárter de aceite, de fundición	
Tornillos	
M 8 x 30 mm -8.8	**21 Nm**
Tornillos	
M 8 x 55 mm -10.9	**21 Nm**
Tornillos de culata	**180 Nm**

171.3 3 cilindros

Prescripción de apriete:

Cárter de aceite, de chapa	
Tornillos	
M 8 x 16 mm -8.8	**21 Nm**

English

174.4 2-Cylinder

Tightening specification:

Sheet metal oil pan
Bolts
M 8 x 16 mm -8.8 **21 Nm**

172. Screw oil drain plug back in with new Cu seal and tighten.

Tightening specification: **55 ± 5 Nm**

173. If adapther housing is provided, mount cover plate. Tighten bolts.

Tightening specification: **9 Nm**

Note: Turn engine by 180°.

174. Fit new O-seal.

Français

171.4 2 cylindres

Consigne de serrage:

Carter d'huile en tôle
Vis
M 8 x 16 mm -8.8 **21 Nm**

172. Placer bouchon de vidange d'huile neuf avec une bague d'étanchéité neuve en Cu et bloquer.

Consigne de serrage: **55 ± 5 Nm**

173. En présence d'un carter d'adaptation, monter tôle de recouvrement. Serrer les vis.

Consigne de serrage: **9 Nm**

Nota: virer le moteur de 180°.

174. Insérer un joint torique neuf.

Español

171.4 2 cilindros

Prescripción de apriete:

Cárter de aceite, de chapa
Tornillos
M 8 x 16 mm -8.8 **21 Nm**

172. Enroscar el tornillo de salida de aceite provisto de una junta anular nueva de cobre y apretarlo.

Prescripción de apriete: **55 ± 5 Nm**

173. Si existe un cárter de adaptación, montar la chapa de recubrimiento. Apretar los tornillos.

Prescripción de apriete: **9 Nm**

Nota: Girar el motor 180°.

174. Colocar un anillo tórico nuevo.

Deutsch

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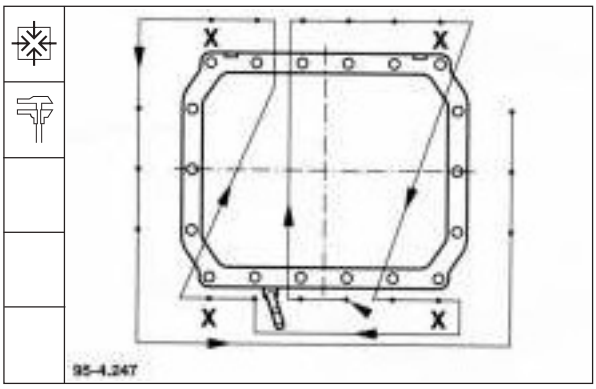
171.4 2-Zylinder

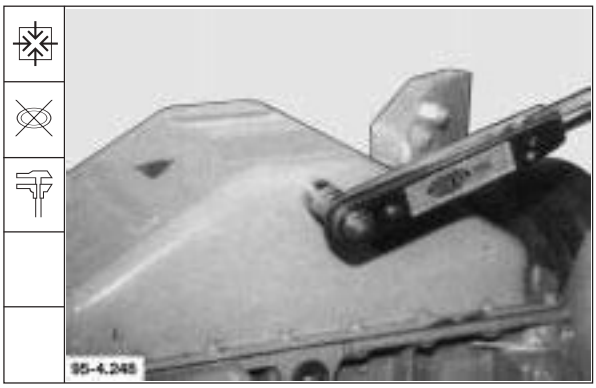
Anziehvorschrift:

Blechölwanne
Schrauben M 8 x 16 mm -8.8 **21 Nm**



172. Ölablaßschraube mit neuem Cu-Dichtring einschrauben und festdrehen.

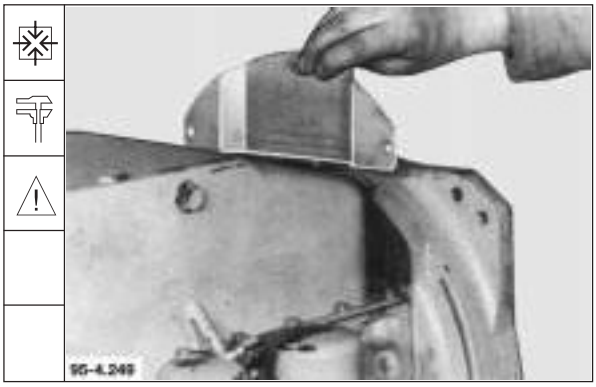
Anziehvorschrift: **55 ± 5 Nm**



173. Falls Anschlußgehäuse, Abdeckblech anbauen. Schrauben festdrehen.

Anziehvorschrift: **9 Nm**

Hinweis: Motor um 180° drehen.



174. Neuen Runddichtring aufziehen.

4

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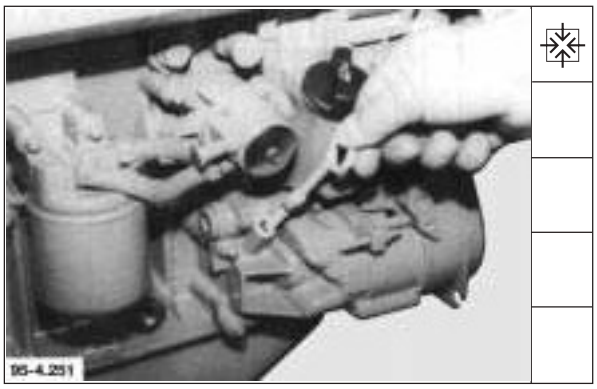
Deutsch

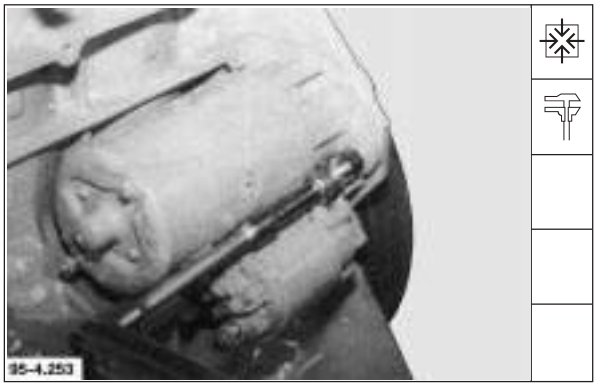


175. Ölmeßstab bis Anschlag eindrücken.

176. Aufstellfuß anbauen. Schrauben festdrehen.

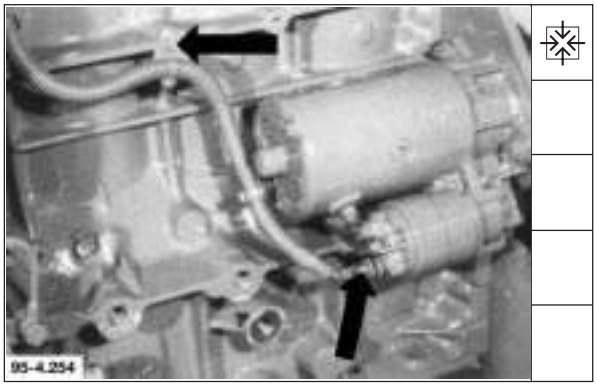
Anziehvorschrift: **200 Nm**

Hinweis: Motor vom Montagebock und Aufspannhalter abbauen.



177. Starter anbauen. Schrauben festdrehen.

Anziehvorschrift: **43,5 Nm**



178. Ladestromleitung an Starter anbauen und verschellen.

English

175. Press in oil dipstick as far as it will go.

176. Fit mounting foot. Tighten bolts.

Tightening specification: **200 Nm**

Note: Remove engine from assembly stand and angled clamping plate.

177. Mount starter. Tighten bolts.

Tightening specification: **43.5 Nm**

178. Fit charging current line to starter and secure with clips.

Français

175. Enfoncer jauge d'huile jusqu'en position de butée.

176. Monter pied de fixation puis serrer les vis.

Consigne de serrage: **200 Nm**

Nota: monter moteur sur le chevalet de montage et déposer le dispositif d'ablocage.

177. Déposer le démarreur et serrer les vis.

Consigne de serrage: **43,5 Nm**

178. Monter la conduite de courant de charge sur le démarreur et fixer à l'aide d'un collier.

Español

175. Introducir hasta el tope la varilla de medición del nivel de aceite.

176. Montar la pata de colocación. Apretar los tornillos.

Prescripción de apriete: **200 Nm**

Nota: Desmontar el motor del caballete de montaje y soporte de fijación.

177. Montar el arrancador. Apretar los tornillos.

Prescripción de apriete: **43,5 Nm**

178. Unir el cable de corriente de carga al arrancador y fijarlo mediante abrazaderas.

English

179. Fit mounting foot. Tighten bolts.

Tightening specification: **200 Nm**

Français

179. Monter pied de fixation et serrer les vis.

Consigne de serrage: **200 Nm**

Español

179. Montar la pata de colocación. Apretar los tornillos.

Prescripción de apriete: **200 Nm**

Deutsch

179. Aufstellfuß anbauen. Schrauben festdrehen.

Anziehvorschrift: **200 Nm**

English

Renewing shaft seals on complete engine

Special tools required:

Puller for shaft seals	142 710
Assembly tool front	142 850
Assembly tool front	142 050
Assembly tool rear	142 860

- Cover flywheel end -

Flywheel has been removed.

1. Press angle hook into shaft seal.
2. Lever shaft seal out of cover using puller.
3. Fit shaft seal with assembly tool without using oil. Sealing lip points towards crankshaft.

Français

Remplacement des joints d'arbre sur moteur complet

Outillage spécial

Extracteur de joints d'arbre	142 710
Dispositif de montage AV	142 850
Dispositif de montage AV	142 050
Dispositif de montage AR	142 860

- Couvercle côté volant -

Le volant moteur a été déposé.

1. Insérer le crochet d'extraction dans le joint d'arbre.
2. Oter le joint d'arbre du couvercle avec le dispositif d'extraction.
3. Monter le joint d'arbre non huilé avec le dispositif à emmancher. La lèvre d'étanchéité doit être dirigée vers le vilebrequin.

Español

Sustitución de los retenes en el motor completo

Herramientas especiales:

Extractor de retenes	142 710
Dispositivo de montaje delantero	142 850
Dispositivo de montaje delantero	142 050
Dispositivo de montaje trasero	142 860

- Tapa, lado de volante -

El volante está desmontado.

1. Introducir a presión el gancho extractor en el retén.
2. Haciendo palanca con el extractor, desmontar el retén de la tapa.
3. Montar sin aceitar el retén con ayuda del dispositivo de montaje. El labio obturante debe indicar hacia el cigüeñal.

Deutsch

Austausch der Wellendichtringe am kompletten Motor

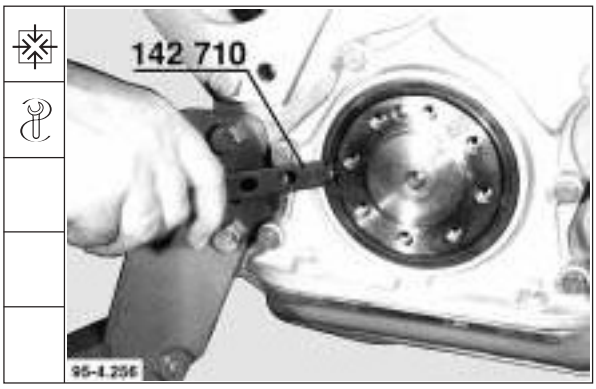
Spezialwerkzeug

Ausziehvorrichtung für
Wellendichtringe _____ 142 710
Montagevorrichtung vorn _____ 142 850
Montagevorrichtung vorn _____ 142 050
Montagevorrichtung hinten _____ 142 860

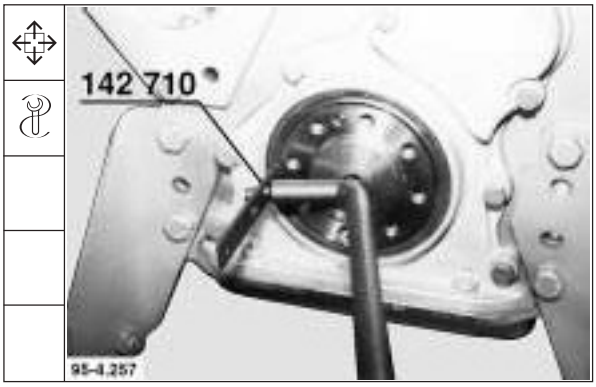
- Deckel Schwungradseite -

Schwungrad ist abgebaut

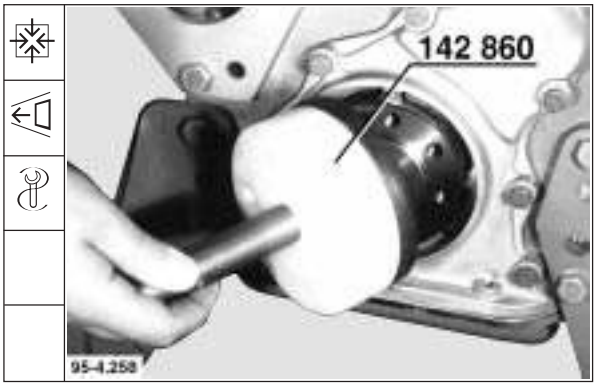
1. Abziehhaken in den Wellendichtring eindrükken.



2. Wellendichtring mit Ausziehvorrichtung aus dem Deckel hebeln.



3. Wellendichtring ungeölt mit Montagevorrichtung montieren. Die Dichtlippe weist zur Kurbelwelle.



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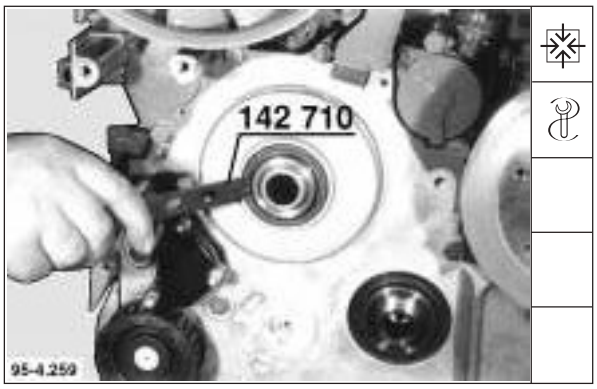
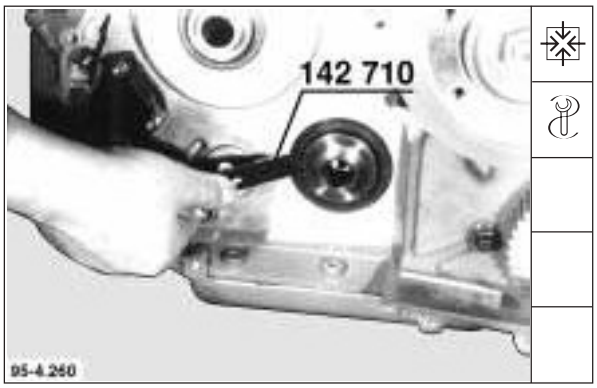
Deutsch



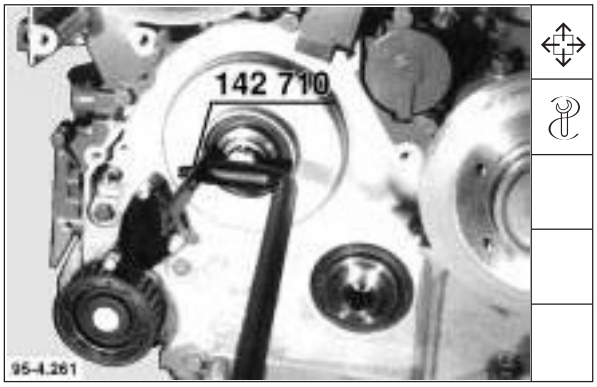
-Vorderer Deckel-

Zahnriemenschutzgehäuse, Nockenwellen- und Kurbelwellenzahnrad sind abgebaut.

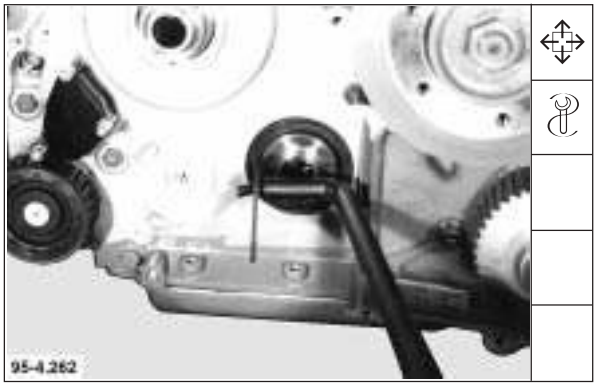
1. Abziehhaken in den Wellendichtring
   -Nockenwelle-



-Kurbelwelle eindrücken-



2. Wellendichtring für Nockenwelle-



-und Kurbelwelle mit Ausziehvorrichtung aushebeln.

English

- Front cover -

Toothed belt guard/camshaft and crankshaft gears have been removed.

1. Press angle hook into seal of
   - camshaft -

   - crankshaft -.

2. Lever out shaft seal for camshaft

   - and crankshaft using puller.

Français

- Couvercle avant -

Le carter protège courroie crantée ainsi que les carters de l'arbre à cames et du vilebrequin ont été déposés.

1. Enfoncer le crochet d'extraction dans le joint de l'arbre à cames

   - dans le joint du vilebrequin -

2. Décoller le joint de l'arbre à cames

   - et du vilebrequin avec le dispositif d'extraction.

Español

- Tapa delantera -

El cárter protector de correas dentadas así como las ruedas dentadas en el árbol de levas y en el cigüeñal están desmontados.

1. Introducir a presión el gancho extractor en el retén para
   - árbol de levas -

   - cigüeñal -

2. Haciendo palanca con el extractor, desmontar el retén para el árbol de levas -

   - y para el cigüeñal.

English

3. Fit seal for camshaft with assembly tool without using oil. Sealing lip points towards camshaft.

4. Fit seal for crankshaft with assembly tool without using oil. Sealing lip points towards crankshaft.

Note: After having fitted shaft seals basic setting of „camshaft relative to crankshaft“ has to be carried out. (See page 4.00.27)

Français

3. Monter avec le dispositif de montage, sans l’huiler, le joint d’arbre à cames. La lèvre d’étanchéité est dirigée vers l’arbre à cames.

4. Monter avec le dispositif de montage, sans l’huiler, le joint du vilebrequin. La lèvre d’étanchéité est dirigée vers le vilebrequin.

Nota: après montage des joints d’arbre procéder à nouveau au réglage de base de „l’arbre à cames par rapport au vilebrequin“. (Voir page 4.00.27)

Español

3. Montar sin aceitar el retén del árbol de levas, utilizando el dispositivo de montaje. El labio de obturación indica hacia el árbol de levas.

4. Montar sin aceitar el retén para el cigüeñal, utilizando el dispositivo de montaje. El labo de obturación indica hacia el cigüeñal.

Nota: Una vez montados los retenes es preciso efectuar el ajuste básico „árbol de levas con respecto al cigüeñal“. (Ver pág. 4.00.27)

Deutsch

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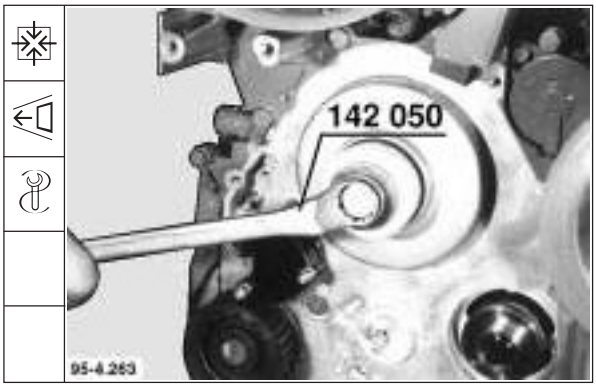
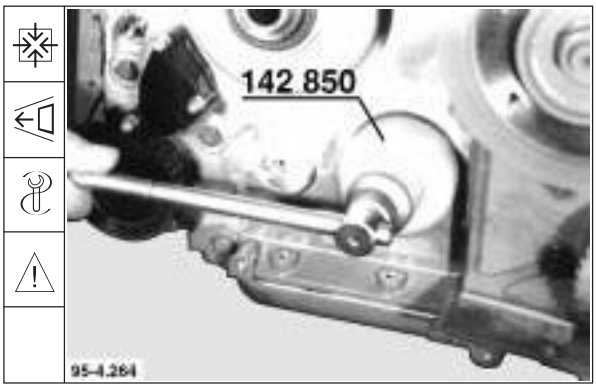
3. Wellendichtring für Nockenwelle ungeölt mit Montagevorrichtung montieren. Die Dichtlippe weist zur Nockenwelle.



4. Wellendichtring für Kurbelwelle ungeölt mit Montagevorrichtung montieren. Die Dichtlippe weist zur Kurbelwelle.

Hinweis: Nach der Montage der Wellendichtringe ist die Grundeinstellung „Nokkenwelle zur Kurbelwelle“ durchzuführen.
(siehe Seite 4.00.27)



English

Removing and refitting exhaust turbocharger

1. Take down oil return pipe.

2. Take down lube oil pipe.

3. Release spring band clips and push upwards.

Note: Replace damaged rubber sleeve.

4. Remove turbocharger.

Note: Replace turbocharger if damaged.

Français

Dépose et repose du turbocompresseur d'échappement

1. Déposer la conduite de retour d'huile.

2. Déposer la tuyauterie d'huile.

3. Desserrer les colliers en feuillard et les pousser vers le haut.

Nota: remplacer manchon en caoutchouc défectueux.

4. Déposer turbocompresseur d'échappement.

Nota: remplacer tout turbocompresseur défectueux.

Español

Desmontaje y montaje del turbocompresor

1. Desmontar el tubo de retorno de aceite.

2. Desmontar la tubería de aceite lubricante.

3. Soltar las abrazaderas de fleje de acero y correrlas hacia arriba.

Nota: Sustituir el manguito de goma defectuoso.

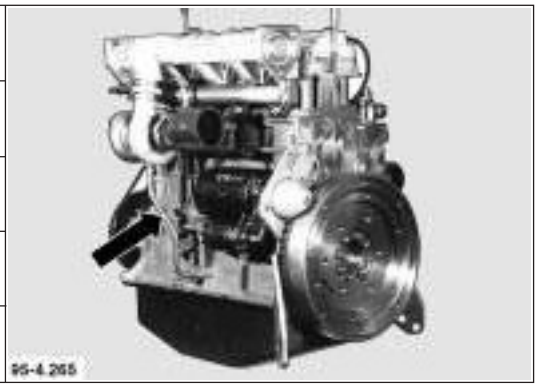
4. Desmontar el turbocompresor.

Nota: Sustituir el turbocompresor defectuoso.

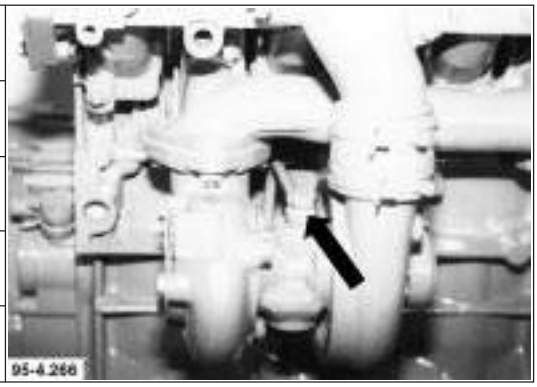
Deutsch

Abgasturbolader ab- und anbauen

1. Ölrücklaufrohr abbauen.

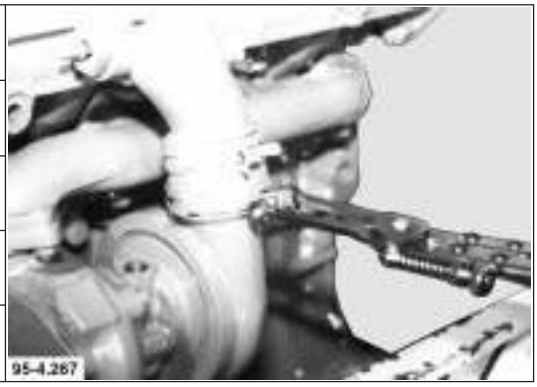


2. Schmierölleitung abbauen.



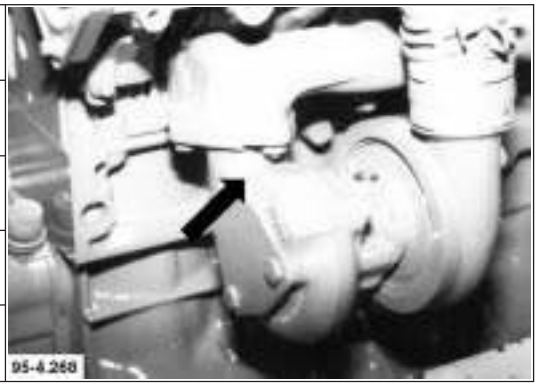
3. Federbandschellen lösen und nach oben schieben.

Hinweis: Schadhafte Gummimuffe austauschen.



4. Abgasturbolader abbauen.

Hinweis: Schadhaften Abgasturbolader austauschen.



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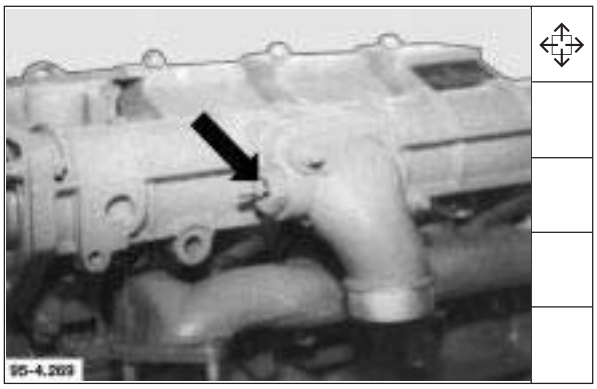
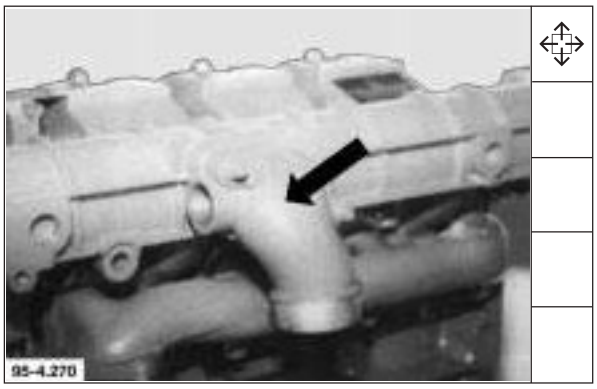
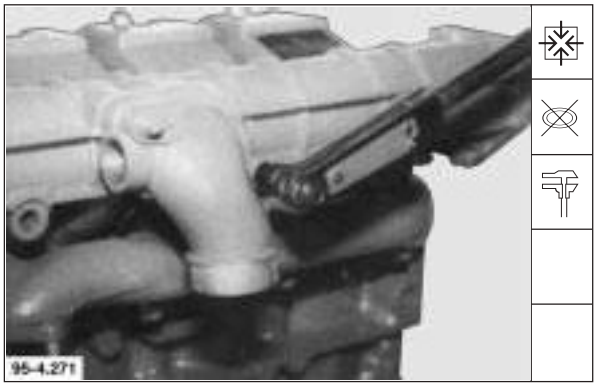


5. Glühwendelkerze ausbauen.

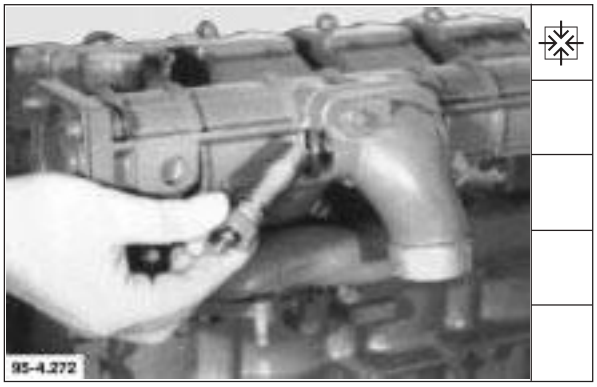


6. Ladeluftkrümmer abbauen.



7. Ladeluftkrümmer mit neuer Dichtung anbauen. Schrauben festdrehen.

   Anziehvorschrift: **21 Nm**



8. Glühwendelkerze anbauen.

English	Français	Español
5. Remove glow-plug filament.	5. Déposer la bougie à filament boudiné.	5. Desmontar la bujía de filamento incandescente.
6. Remove charge air elbow.	6. Déposer la tubulure d'air de suralimentation.	6. Desmontar el codo de aire de sobrealimentación.
7. Mount charge air elbow with new seal. Tighten bolts. Tightening specification: **21 Nm**	7. Monter tubulure d'air de suralimentation avec joint neuf. Serrer les vis. Consigne de serrage: **21 Nm**	7. Montar el codo de aire de sobrealimentación con una junta nueva. Apretar los tornillos. Prescripción de apriete: **21 Nm**
8. Fit glow-plug filament.	8. Reposer la bougie à filament boudiné.	8. Montar la bujía de filamento incandescente.

English

9. Tighten glow-plug filament.

   Tightening specification: **60 Nm**

10. Position rubber sleeve and push spring band clips upwards.

11. Mount turbocharger together with new gasket.

Note: Apply Never Seize paste DEUTZ **S1** to studs.

12. Tighten nuts.

    Tightening specification: **29 Nm**

Français

9. Serrer la bougie à filament boudiné.

   Consigne de serrage: **60 Nm**

10. Placer manchon en caoutchouc et pousser vers le haut les colliers en feuillard.

11. Monter turbocompresseur d'échappement avec joint neuf.

Nota: enduire les goujons de pâte Never Seize DEUTZ **S1.**

12. Serrer les écrous.

    Consigne de serrage: **29 Nm**

Español

9. Apretar la bujía de filamento incandescente.

   Prescripción de apriete: **60 Nm**

10. Colocar el manguito de goma y correr hacia arriba las abrazaderas.

11. Montar el turbocompresor provisto de una junta nueva.

Nota: Aplicar pasta Never Seize DEUTZ **S1** a los espárragos.

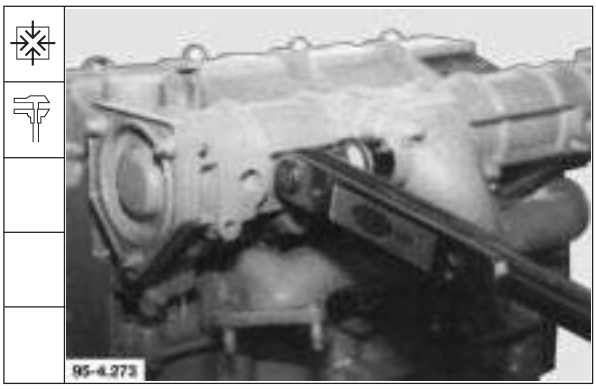
12. Apretar las tuercas.

    Prescripción de apriete: **29 Nm**

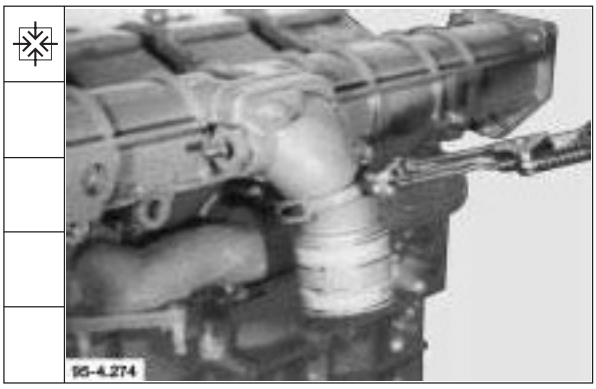
Deutsch

9. Glühwendelkerze festdrehen.

   Anziehvorschrift: **60 Nm**

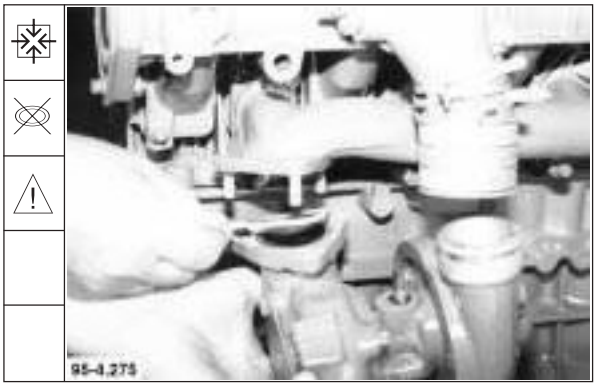


10. Gummimuffe aufsetzen und Federbandschellen nach oben schieben.



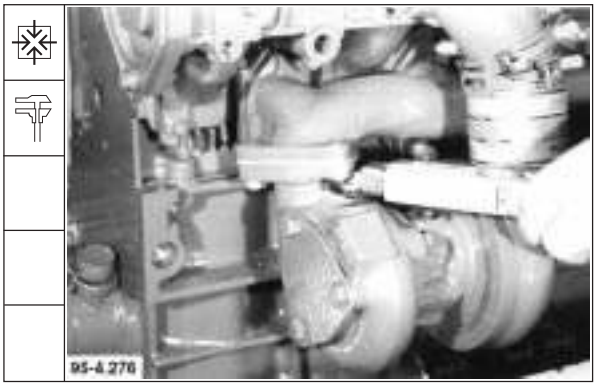
11. Abgasturbolader mit neuer Dichtung anbauen.

Hinweis: Stiftschrauben mit Never Seize Paste DEUTZ **S1** bestreichen.



12. Muttern festdrehen.

    Anziehvorschrift: **29 Nm**



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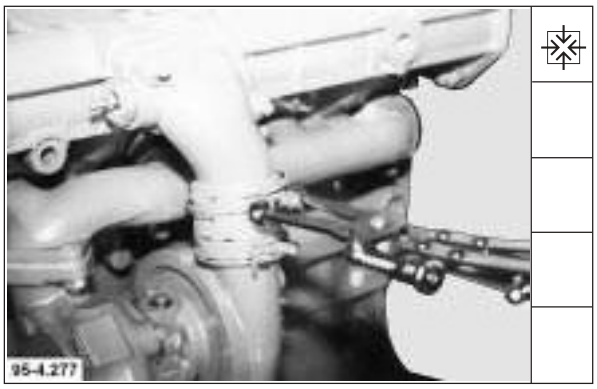
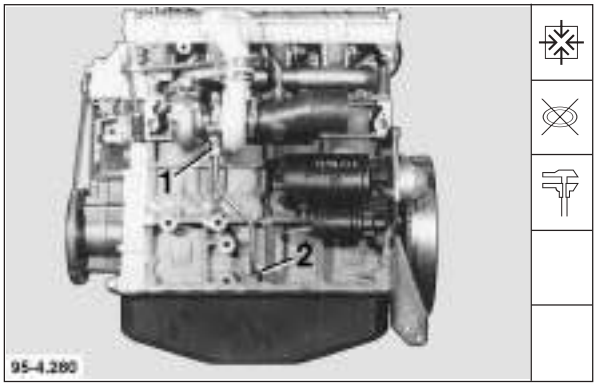


13. Federbandschellen montieren.

14. Schmierölleitung mit neuen Cu-Dichtringen anbauen.

15. Hohlschrauben festdrehen.

    Anziehvorschrift: **28 Nm**



16. Ölrücklaufrohr mit neuem Runddichtring anbauen. Überwurfmutter Pos. 1 festdrehen. Haltebügel anbauen und Schraube Pos. 2 festdrehen.

Anziehvorschrift:	Pos. 1	**60 ± 3 Nm**
	Pos. 2	**8,5 Nm**

4

English

13. Fit spring band clips.

14. Fit lube oil pipe with new Cu seals.

15. Tighten banjo bolts.

    Tightening specification: **28 Nm**

16. Fit oil return pipe with new O-seal. Tighten cap nut, item 1. Fit retainer and tighten bolt, item 2.

    Tightening specification: item 1 **60 ± 3 Nm**
    item 2 **8.5 Nm**

Français

13. Monter les colliers.

14. Monter conduite d'huile avec bague d'étanchéité neuves en Cu.

15. Serrer les vis creuses.

    Consigne de serrage: **28 Nm**

16. Monter tube de retour avec joint torique neuf. Serrer écrou-raccord (1). Monter étrier de maintien et serrer vis (2).

    Consigne de serrage: rep.1 **60 ± 3 Nm**
    rep 2 **8,5 Nm**

Español

13. Montar las abrazaderas.

14. Montar la tubería de aceite lubricante con juntas anulares nuevas de cobre.

15. Apretar los tornillos racores.

    Prescripción de apriete: **28 Nm**

16. Montar el tubo de retorno de aceite con un anillo tórico nuevo. Apretar la tuerca de empalme (1). Montar el estribo de soporte y apretar el tornillo (2).

    Prescripción de apriete: (1) **60 ± 3 Nm**
    (2) **8,5 Nm**

English

Different assembly variants

Removing and refitting alternator and fan drive

Commercial tool required:

V-belt tension gauge _____ 91 107

1. Remove alternator. Take off V-belt.
2. Remove bracket.
3. Remove complete fan drive.

Français

Diverses variantes de montage

Déposer et reposer alternateur et entraînement du ventilateur

Appareil de mesure de tension de courroie _____ 91107

1. Déposer alternateur. Retirer la courroie.
2. Déposer la console.
3. Déposer entraînement du ventilateur complet.

Español

Diversas variantes de adosamiento de elementos

Desmontaje y montaje del alternador y accionamiento del ventilador

Herramienta comercial:

Verificador de tensión para correas trapezoidales ____ 91107

1. Desmontar el alternador. Quitar la correa trapezoidal.
2. Desmontar la consola.
3. Desmontar el accionamiento completo del ventilador.

Deutsch

Werkstatthandbuch 1011 F

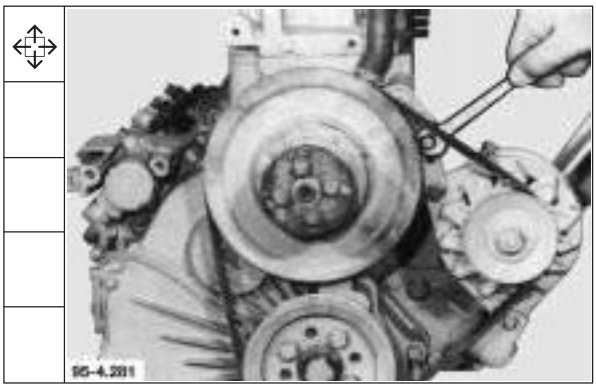
Verschiedene Anbauvarianten

Generator und Lüfterantrieb ab- und anbauen

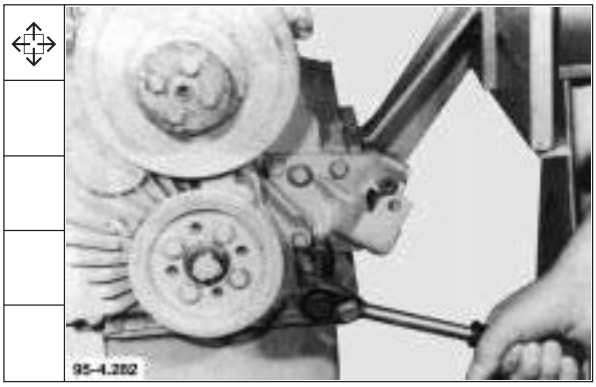
Handelsübliches Werkzeug:

Keilriemenspannungs-Meßgerät _____ 91107

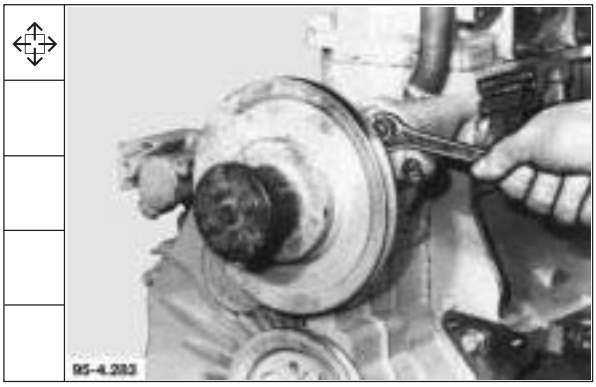
1. Generator abbauen. Keilriemen abnehmen.



2. Konsole abbauen.



3. Lüfterantrieb komplett abbauen.



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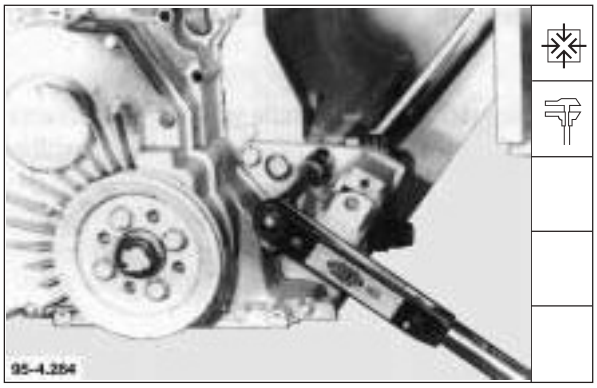
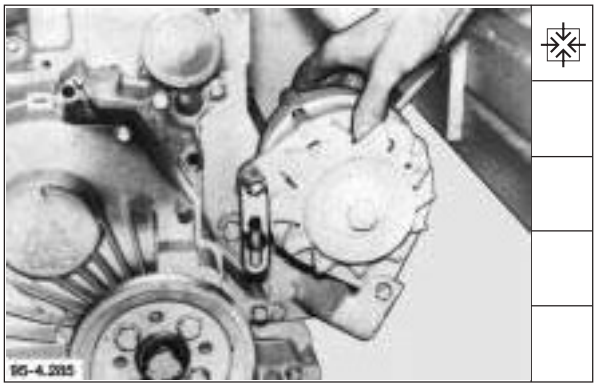
Deutsch

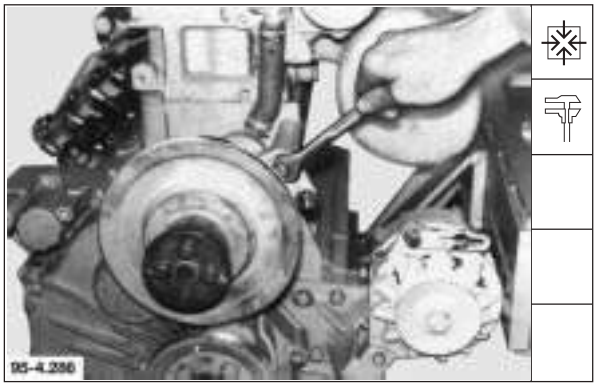


4. Konsole für Generator anbauen. Schrauben festdrehen.

   Anziehvorschrift: **40,5 Nm**

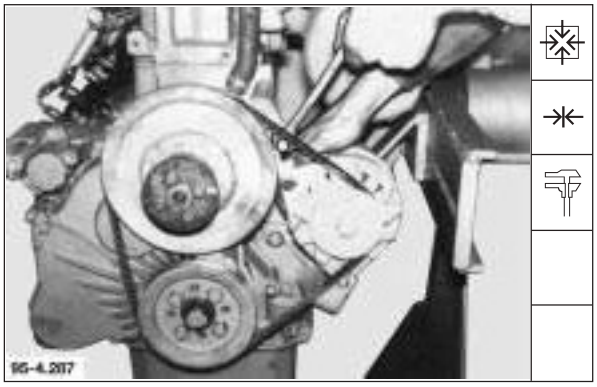


5. Generator anbauen. Schrauben leicht andrehen.



6. Lüfterantrieb komplett mit Keilriemenscheibe anbauen. Schrauben festdrehen.

   Anziehvorschrift: **21 Nm**



7. Keilriemen spannen. Schrauben festdrehen.

   Anziehvorschrift: **21 Nm**

English

4. Fit bracket for alternator. Tighten bolts.

   Tightening specification: **40.5 Nm**

5. Fit alternator. Start bolts.

6. Fit fan drive complete with V-belt pulley. Tighten bolts.

   Tightening specification: **21 Nm**

7. Tension V-belt. Tighten bolts.

   Tightening specification: **21 Nm**

Français

4. Monter console de l'alternateur. Serrer légèrement les vis.

   Consigne de serrage**: 40,5 Nm**

5. Monter alternateur. Serrer légèrement les vis.

6. Monter entraînement de l'alternateur complet avec poulie à gorge. Serrer les vis.

   Consigne de serrage**: 21 Nm**

7. Serrer la courroie et les vis.

   Consigne de serrage**: 21 Nm**

Español

4. Montar la consola para el alternador. Apretar los tornillos.

   Prescripción de apriete: **40,5 Nm**

5. Montar el alternador. Apretar ligeramente los tornillos.

6. Montar el accionamiento completo del ventilador con polea de correa trapezoidal. Apretar los tornillos.

   Prescripción de apriete: **21 Nm**

7. Tensar la correa trapezoidal. Apretar los tornillos.

   Prescripción de apriete: **21 Nm**

English

8. Check V-belt tension with tension gauge.

Initial assembly:	**400 ± 20 N**
Check value after 15 min. operation under load:	**300 ± 20 N**

Removing and refitting alternator

Commercial tool required:

V-belt tension gauge _____ 91 107

9. Remove alternator. Take off V-belt.

10. Remove bracket.

Français

8. Vérifier la tension de courroie à l'aide de l'appareil de contrôle.

Première monte	**400 ± 20 N**
Valeur de contrôle après une marche de 15 minutes sous charge:	**300 ± 20 N**

Déposer et reposer l'alternateur

Outil usuel:

Appareil de mesure de tension de courroie _____ 91107

9. Déposer alternateur. Retirer la courroie.

10. Déposer la console.

Español

8. Comprobar la tensión de la correa trapezoidal mediante el verificador de tensión.

Primer montaje:	**400 ± 20 N**
Valor de control tras marcha de 15 minutos bajo carga	**300 ± 20 N**

Desmontaje y montaje del alternador

Herramienta comercial:

Verificador de tensión para correas trapezoidales ____ 91107

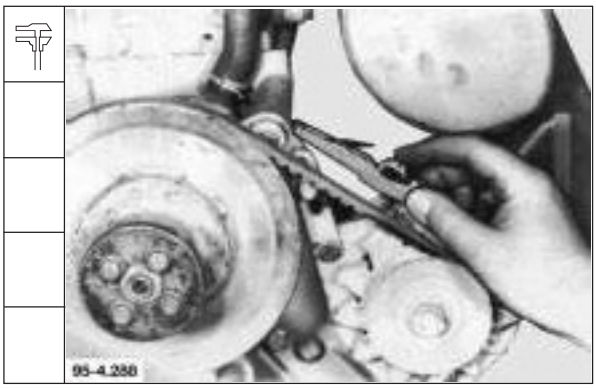
9. Desmontar el alternador. Quitar la correa trapezoidal.

10. Desmontar la consola.

Deutsch

8. Keilriemenspannung mit Spannungsmeßgerät prüfen.

   Erstmontage: **400 ± 20 N**
   Kontrollwert nach
   15 Minuten Lauf unter Last: **300 ± 20 N**

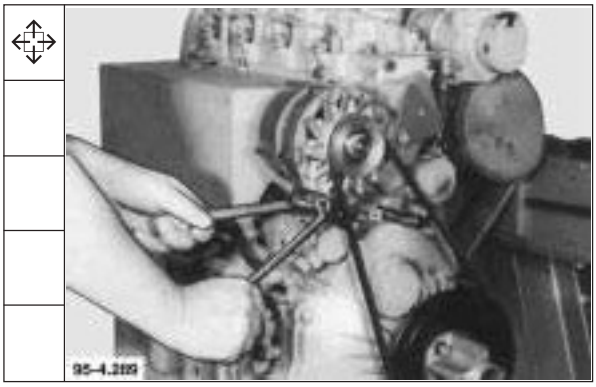


Generator ab- und anbauen

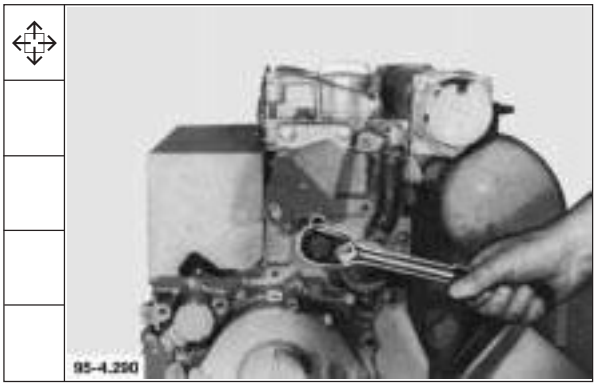
Handelsübliches Werkzeug:

Keilriemenspannungs-Meßgerät _____ 91107

9. Generator abbauen. Keilriemen abnehmen.



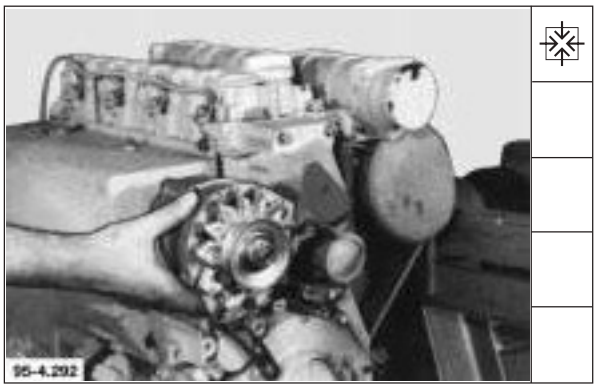
10. Konsole abbauen.



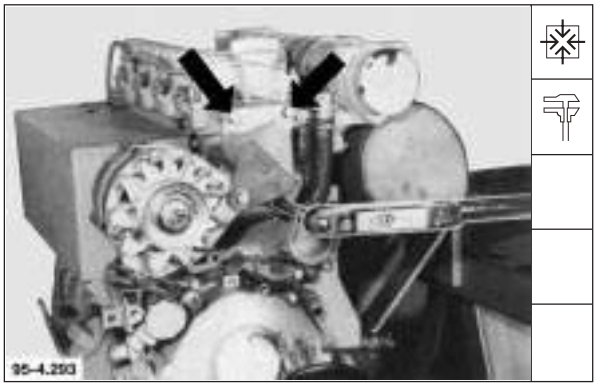
Werkstatthandbuch 1011 F

Deutsch

11. Konsole anbauen. Schrauben leicht andrehen.

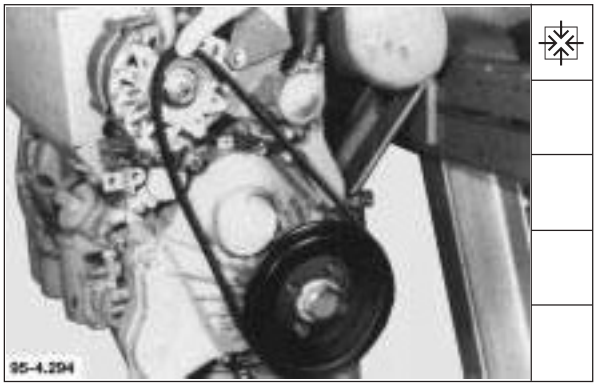


12. Generator anbauen. Schrauben leicht andrehen.



13. Schrauben festdrehen.

    Anziehvorschrift: **31 Nm**



14. Keilriemen auflegen.

English	Français	Español
11. Fit bracket. Start bolts.	11. Monter console. Serrer légèrement les vis.	11. Montar la consola. Apretar ligeramente los tornillos.
12. Fit alternator. Start bolts.	12. Déposer alternateur et serrer les vis modérément.	12. Montar el alternador. Apretar ligeramente los tornillos.
13. Tighten bolts. Tightening specification: **31 Nm**	13. Serrer les vis. Consigne de serrage**: 31 Nm**	13. Apretar los tornillos. Prescripción de apriete: **31 Nm**
14. Position V-belt.	14. Placer la courroie.	14. Colocar la correa trapezoidal.

English

15. Tension V-belt.

16. Check V-belt tension with tension gauge.

Initial assembly:	**400 ± 20 N**
Check value after 15 min. operation under load	**300 ± 20 N**

17. After completed belt tensioning, tighten remaining bolts.

Tightening specification:	item 1	**43.5 Nm**
	item 2	**22 Nm**
	item 3	**31 Nm**

Français

15. Tendre la courroie.

16. Vérifier la tension de courroie à l'aide de l'appareil de contrôle.

Première monte	**400 ± 20 N**
Valeur de contrôle après marche de 15 minutes sous charge:	**300 ± 20 N**

17. Avoir avoir tendu la courroie serrer les autres vis.

Consigne de serrage:	Rep. 1	**43,5 Nm**
	Rep. 2	**22 Nm**
	Rep. 3	**31 Nm**

Español

15. Tensar la correa trapezoidal.

16. Comprobar la tensión de la correa trapezoidal mediante el verificador de tensión.

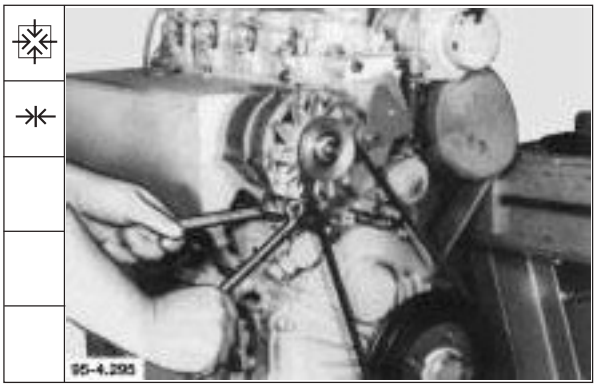
Primer montaje:	**400 ± 20 N**
Valor de control tras marcha de 15 minutos bajo carga	**300 ± 20 N**

17. Terminado el tensado de la correa trapezoidal, deberán apretarse los tornillos restantes.

Prescripción de apriete:	(1)	**43,5 Nm**
	(2)	**22 Nm**
	(3)	**31 Nm**

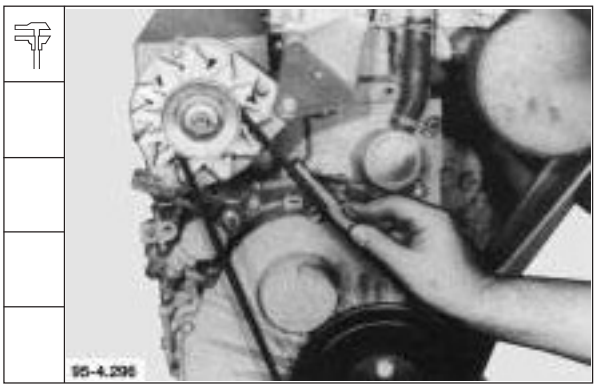
Deutsch

15. Keilriemen spannen.



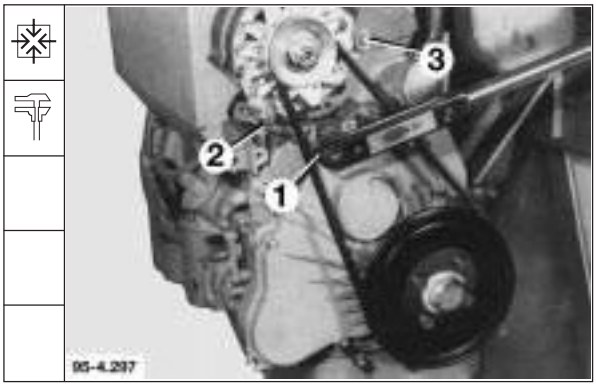
16. Keilriemenspannung mit Spannungsmeßgerät prüfen.

Erstmontage:	**400 ± 20 N**
Kontrollwert nach 15 Minuten Lauf unter Last:	**300 ± 20 N**



17. Nach dem Keilriemenspannen sind die übrigen Schrauben festzudrehen.

Anziehvorschrift:	Pos. 1	**43,5 Nm**
	Pos. 2	**22 Nm**
	Pos. 3	**31 Nm**



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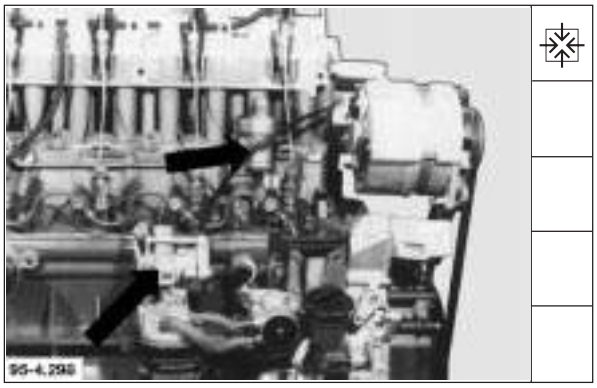
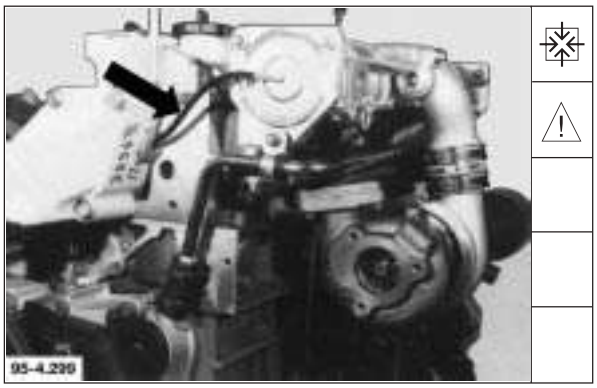
Deutsch



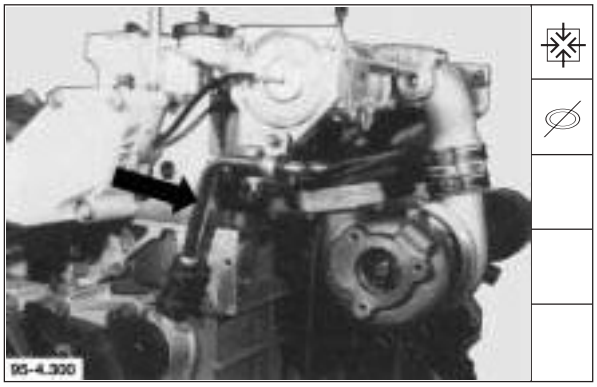
Ladedruckabhängiger Vollastanschlag (LDA)

1. Einbaulage des ladedruckabhängigen Vollastanschlages mit Schlauchleitung.



2. Einbaulage LDA-Schlauchleitung.

Hinweis: Bei Austausch durch Gummimuffe führen.



Kurbelgehäuse-Entlüftung

3. Einbaulage Kurbelgehäuse-Entlüftung.
   Bei Bedarf Gummimuffe austauschen.

English

Manifold-pressure compensator (LDA)

1. Installation position of LDA with hose line.

2. Installation position of LDA hose line.

Note: When replacing LDA introduce through rubber sleeve.

Crankcase breather

3. Installation position of crankcase breather. Renew rubber sleeve if necessary.

Français

Correcteur de débit (LDA)

1. Sens de montage du correcteur de débit avec conduite flexible.

2. Sens de montage de la conduite flexible du LDA.

Nota: pour changer la conduite la faire passer à travers le manchon en caoutchouc.

Event de carter

3. Sens de montage de l'évent de carter.Au besoin changer manchon en caoutchouc.

Español

Tope de plena carga dependiente de la presión de sobrealimentación (LDA)

1. Posición de montaje del tope de plena carga dependiente de la presión de sobrealimentación con manguera.

2. Posición de montaje de la manguera del LDA.

Nota: En caso de sustitución pasarla por el manguito de goma.

Ventilación del cárter

3. Posición de montaje del sistema de ventilación del cárter. Sustituir el manguito de goma, si es necesario.

Werkzeuge

Tools

Outils

Herramientas

1011 F

DEUTZ

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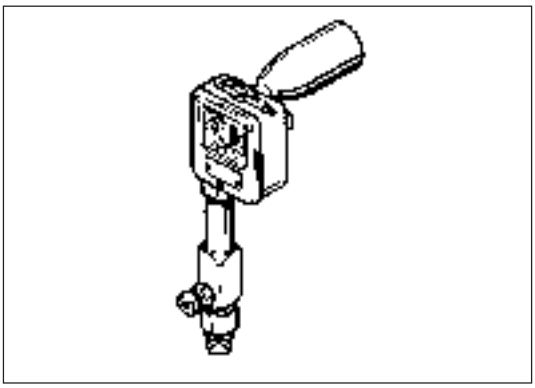
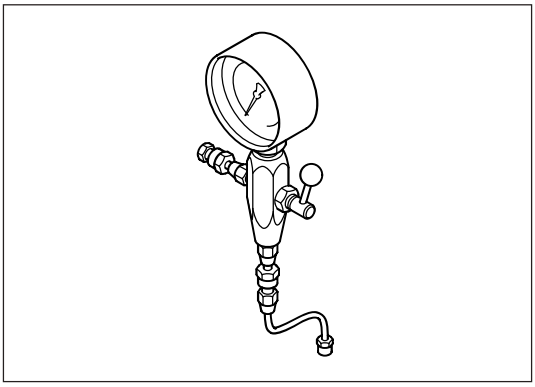
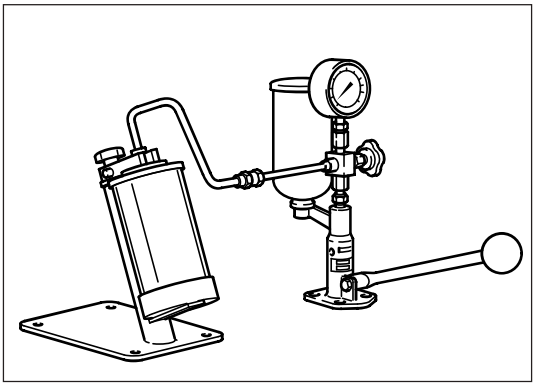
Deutsch English Français Español	No.	Werkstatthandbuch 10111 F
Torx-Werkzeugsatz Torx tool kit Jeu d'outils Torx Juego de herramientas Torx	**8189**	
Kompressionsdruckprüfer Compression tester Compressiomètre Compresímetro	**8005**	
Einspritzpumpenprüfgerät Injection pump tester Appareil de contrôle de la pompe d'injection Comprobador para bombas de inyección	**8006**	
Düsenprüfgerät Nozzle tester Banc d'essais d'injecteurs Comprobador para inyectores	**8008**	

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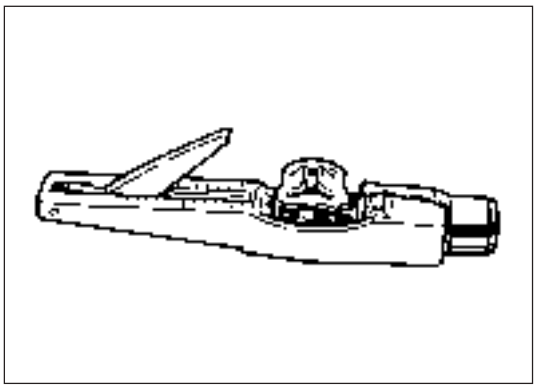
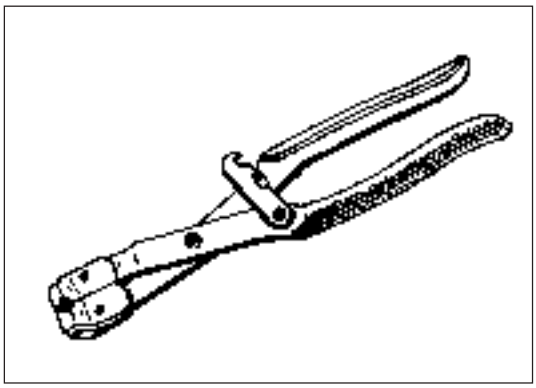
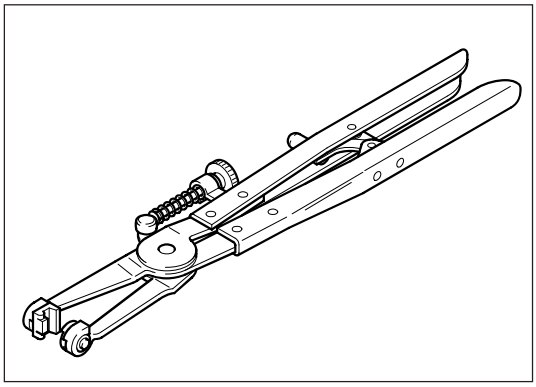
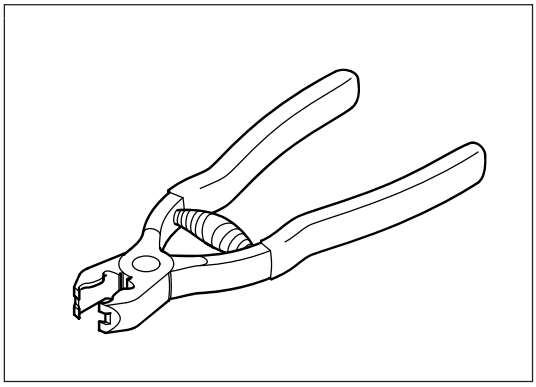
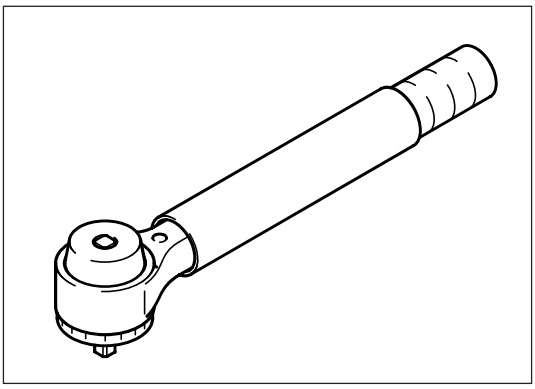
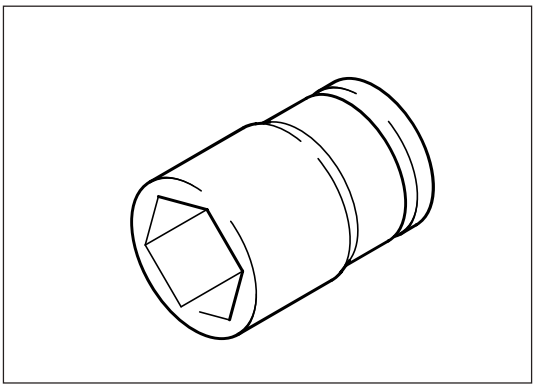
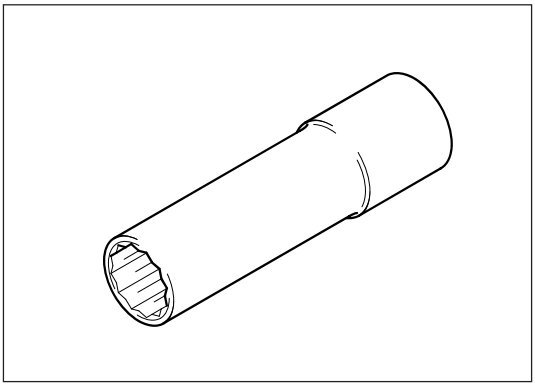
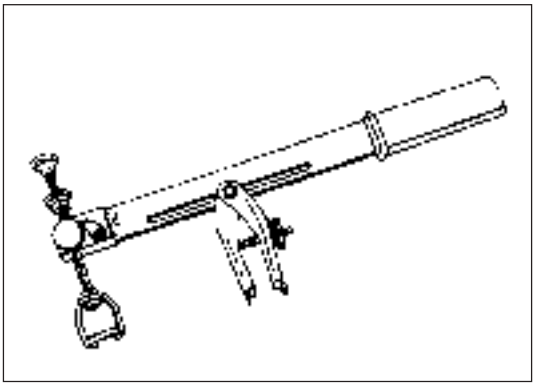
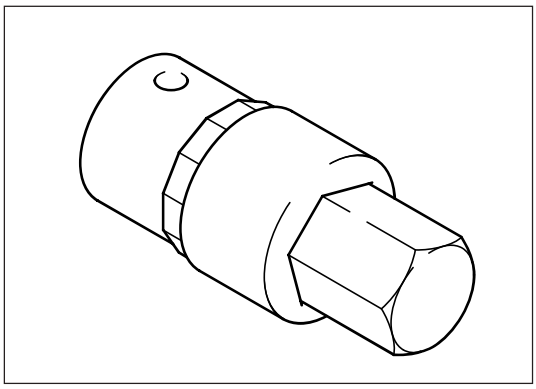
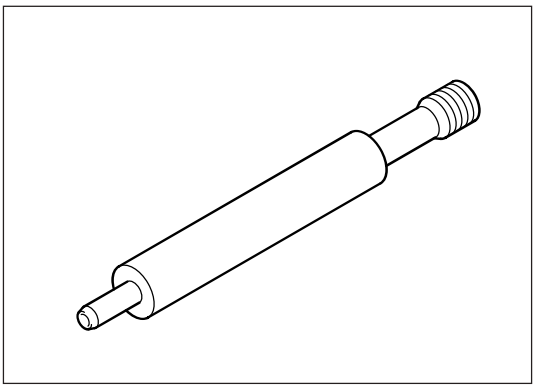
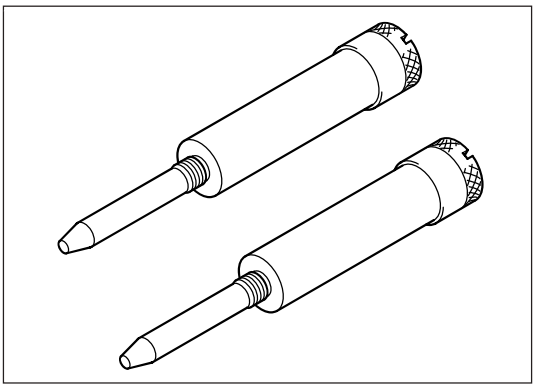
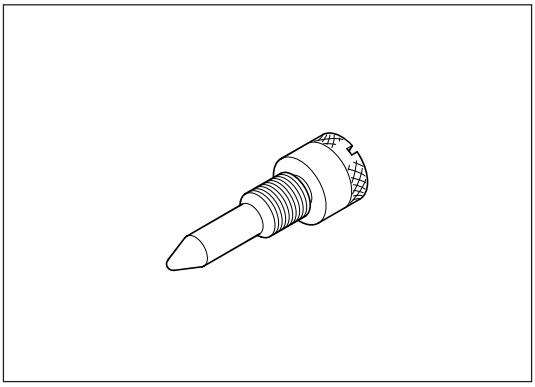
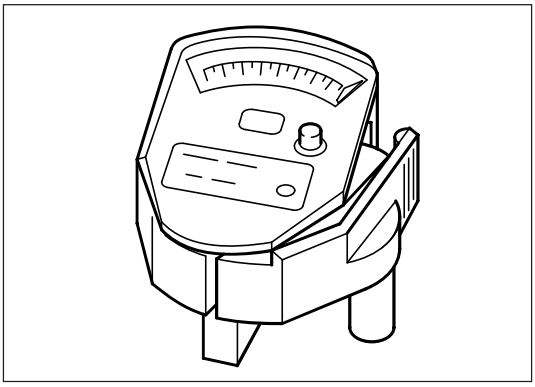
	No.	Deutsch English Français Español
	**8115**	Keilriemenspannungsmeßgerät V-belt tension gauge Appareil de mesure de la tension de courroie Verificador de tensión de correas trapezoidales
	**9088**	Schlauchklemmenzange Hose clip pliers Pince à tuyaux flexibles Alicates para abrazaderas de mangueras
	**9090**	Federklemmenzange Spring clamp pliers Pince à ressorts Alicates para abrazaderas de resorte
	**8011**	Cobraklemmenzange Cobra clamp pliers Pince à ressorts Cobra pour tuyaux Alicates Cobra para abrazaderas

Deutsch English Français Español	No.	Werkstatthandbuch 10111 F
Kraftvervielfältiger für Zentralschraube Multipower tool for central bolt Multiplicateur de force pour vis centrale Multiplicador de fuerza	**8049**	
Stecknuß SW 32 Socket a/flats 32 Clé à douille de 32 Llave de vaso de 32	**8036**	
Lange Stecknuß SW 15 Long socket a/flats 15 Clé à douille longue de 15 Llave de vaso largo de 15	**8021**	
Ventilfedermontagehebel Valve spring assembly lever Levier de montage pour ressorts de soupape Palanca de montaje para resortes de válvula	**9017**	

Werkstatthandbuch 1011 F



No.	Deutsch English Français Español
8112	Schraubendrehereinsatz 1/2" SW 17 Screw driver socket 1/2" a/flats 17 Embout tournevis 1/2" de 17 Punta recambiable de destornillador, 1/2" SW 17

Deutsch English Français Español	No.	Werkstatthandbuch BFM 1011 F
Anschlußstück für Kompressionsdruckprüfer Adapter for compression tester Raccord pour compressiomètre Pieza de empalme para el compresímetro	**100 120**	
Einstellbolzen für Kurbel- und Nockenwelle Adjusting pin for crankshaft and camshaft Pige de calage pour vilebrequin et arbre à cames Pernos de ajuste para el cigüeñal y árbol de levas	**100 700**	
Einstellbolzen für Einspritzpumpenregelstange Adjusting pin for injection pump control rod Pige de calage pour crémaillère de pompe d'injection Perno de ajuste para la barra cremallera de la bomba de inyección	**100 710**	
Zahnriemenspannungsmeßgerät Toothed belt tension gauge Appareil de mesure de tension de courroie crantée Verificador de tensión de correas dentadas	**100 720**	

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No.	Deutsch English Français Español
100 750	Meßgerät mit Abstandsscheiben für Kolbenüberstand und vorderen Deckel Gauge with spacers for piston projection and front cover Appareil de mesure du retrait de piston et couvercle avant avec rondelles d'écartement Dispositivo de medición con arandelas distancia- doras para saliente de pistón y tapa delantera
100 870 **880**	Arretierungsdraht für Anlenkhebel Einspritzpumpe Locking wire for control lever, injection pump Fil d'arrêt pour levier articulé de pompe d'injection Alambre de sujeción para la palanca articulada, bomba de inyección
103 020	Prüfschablone für E.P.-Dichtung Test template for I.P. gasket Gabarit de contrôle pour joint de pompe d'injection Plantilla para comprobar juntas de b.i.
110 110	Halter für Einspritzventil Retainer for injector Dispositif d'immobilisation pour injecteur Soporte de inyectores

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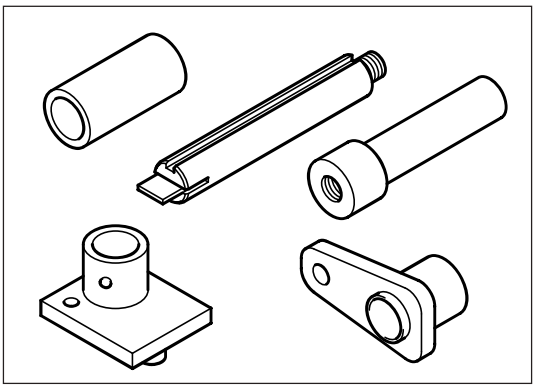
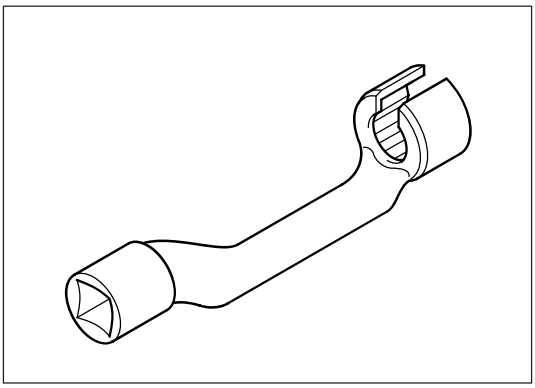
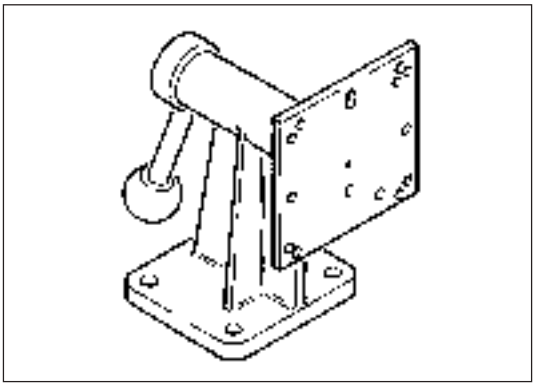
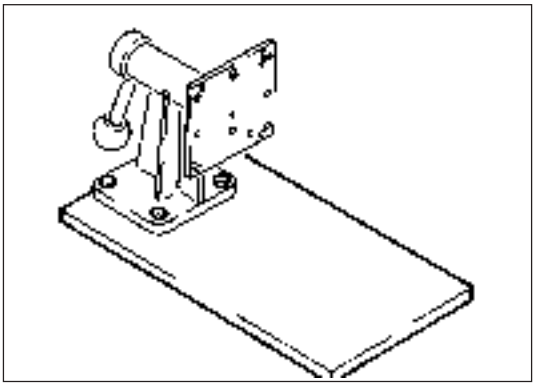
Montagewerkzeug für Regelstangenbuchse Assembly tool for control rod bush Outil de montage pour douille de crémaillère Herramienta de montaje para manguitos de cremallera	**110 140**	
Spezialschlüssel für Einspritzleitung Special wrench for injection line Clé spécial pour conduite d'injection Llave especial para tuberías de inyección	**110 490**	
Aufspannbock für Zylinderkopf Clamping stand for cylinder heads Chevalet d'ablocage pour culasse Soporte de fijación para culatas	**120 900**	
Aufspannplatte für No 120 900 Clamping plate for 120 900 Plaque d'ablocage pour no. 120 900 Placa de fijación para 120 900	**120 910**	

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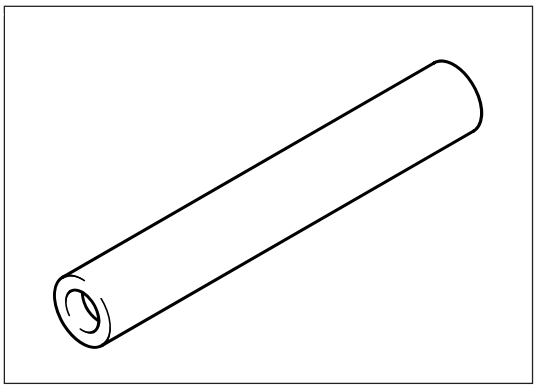
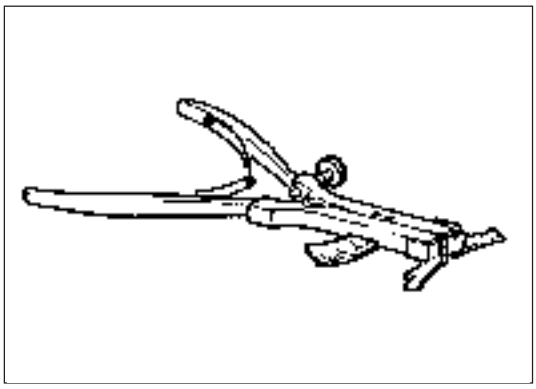
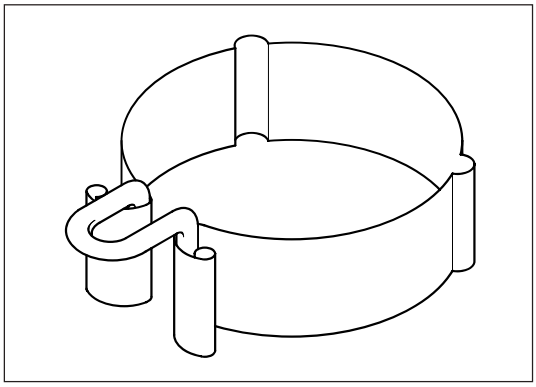
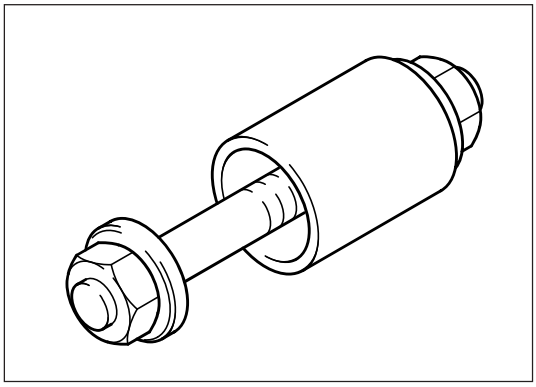
	No.	Deutsch English Français Español
	**121 410**	Montagewerkzeug für Ventilschaftabdichtung Sleeve for fitting valve stem seal Outil de montage pour joint de tige de soupape Util de montaje para juntas de vástago de válvula
	**130 300**	Universal-Kolbenring-Auflegezange Universal piston ring pliers Pince universelle à monter les segments de piston Alicates universales para montar aros de pistón
	**130 510**	Kolbenringspannband Piston ring compressor Collier à comprimer les segments de piston Compresor de aros de pistón
	**131 340** **131 350**	Montagevorrichtung für Kolbenbolzenbuchse Assembly tool for small end bush Dispositif de montage de bague de pied de bielle Herramienta de montaje para casquillos de pie de biela

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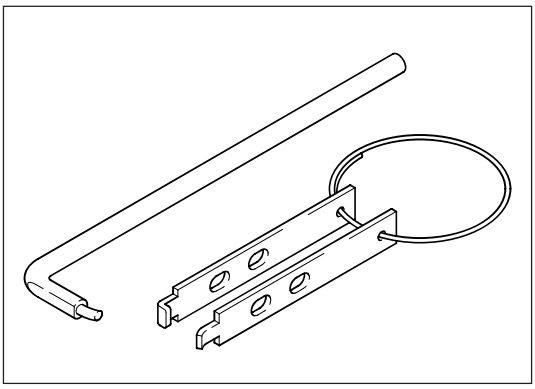
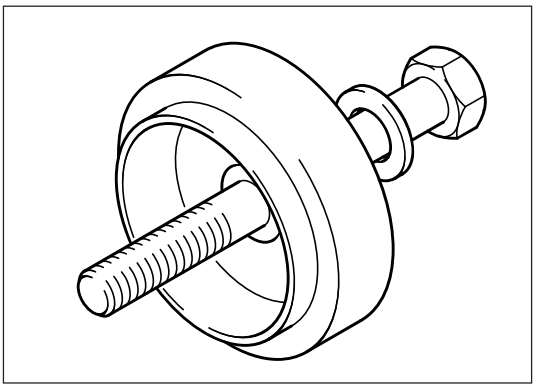
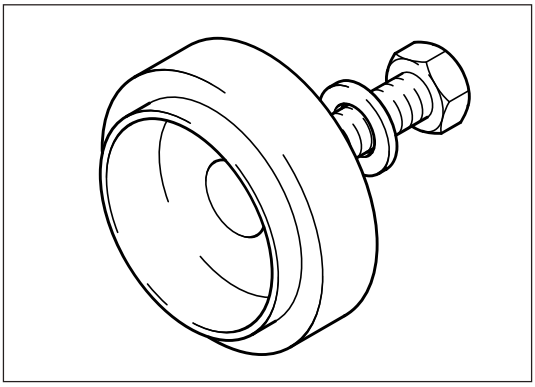
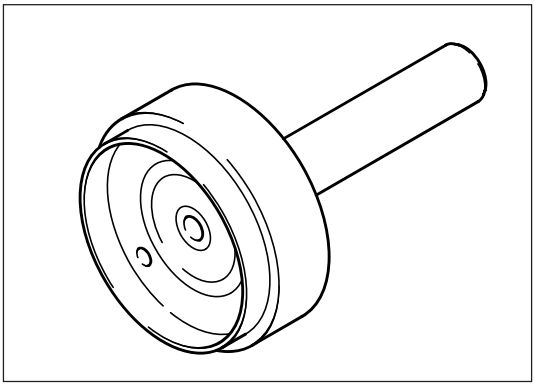
Ausziehvorrichtung für Kurbelwellendichtringe Puller for crankshaft seals Extracteur pour bagues d'étanchéité de vilebrequin Dispositivo de extracción para retenes del cigüeñal	**142 710**	
Montagevorrichtung für Nockenwellendichtring Assembly tool for camshaft seals Dispositif de montage pour bagues d'étanchéité d'arbre à cames Dispositivo de montaje para retenes del árbol de levas	**142 050**	
Montagevorrichtung für Kurbelwellendichtring, vorne Assembly tool for crankshaft seals,front Dispositif de montage de bague d'étanchéité avant de vilebrequin Dispositivo de montaje para el retén delantero del cigüeñal	**142 850**	
Montagevorrichtung für Kurbelwellendichtring, hinten Assembly tool for crankshaft seals, rear Dispositif de montage pour bague d'étanchéité arrière de vilebrequin Dispositivo de montaje para el retén trasero del cigüeñal	**142 860**	

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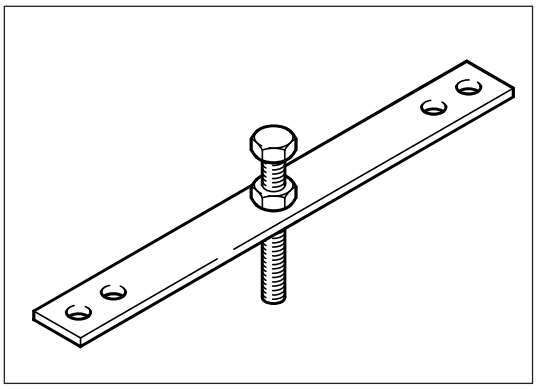
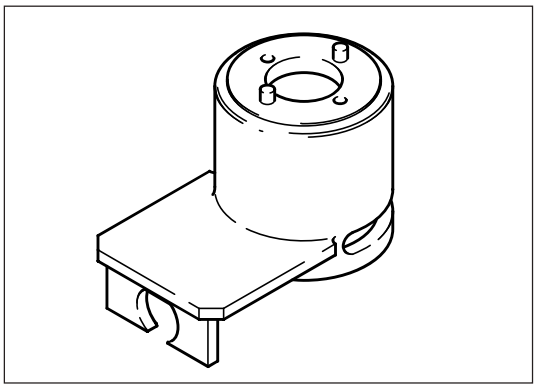
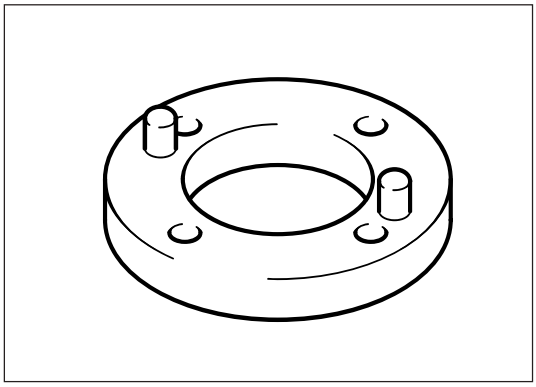
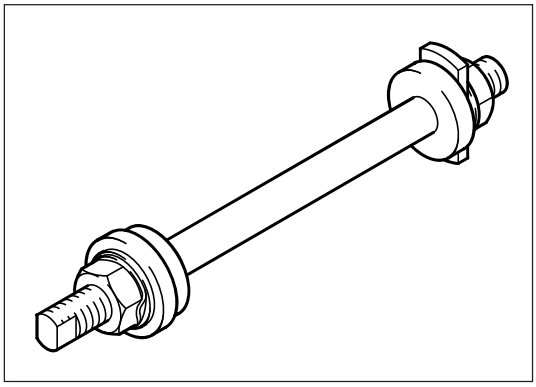
	No.	Deutsch English Français Español
	**143 100**	Abdrückvorrichtung für Schwungrad Puller for flywheel Dispositif pour extraction de volant-moteur Dispositivo de separación para el volante
	**143 420**	Gegenhalter für Kraftvervielfältiger Dolly for multipower tool Dispositif de maintien du multiplicateur de force. Contrasoporte para el multiplicador de fuerza
	**143 430**	Zwischenscheibe für Gegenhalter 143 420 Intermediate disc for dolly 143 420 Disque intercalaire pour outil de maintien 143 430 Arandela intermedia para el contrasoporte 143 420
	**143 820**	Montagevorrichtung für Nockenwellenbuchse Assembly tool for camshaft bush Outil de montage pour bague d'arbre à cames Dispositivo de montaje para casquillos de árbol de levas

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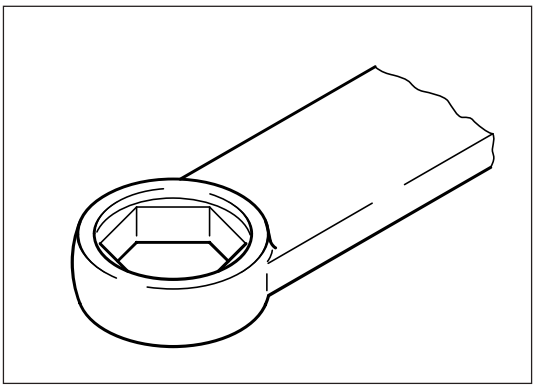
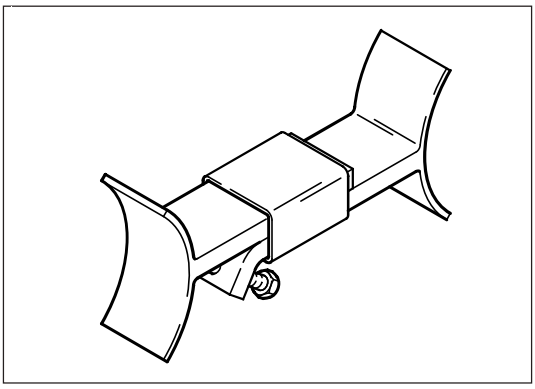
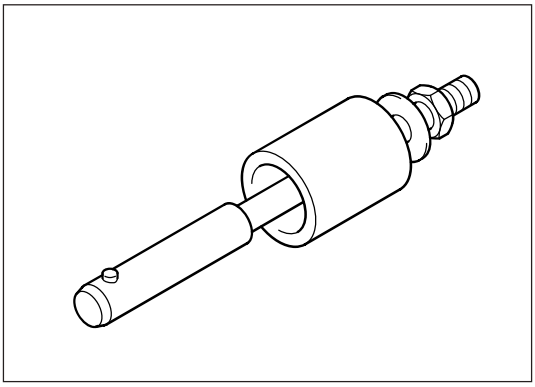
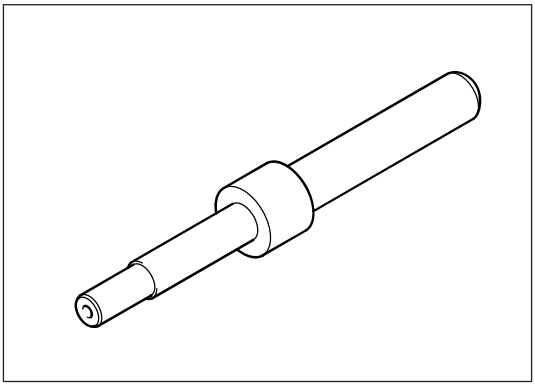
Gegenhalter für Nockenwellenrad Dolly for camshaft gear Outil de maintien de pignon d'arbre à cames Contrasoporte para la rueda dentada en el árbol de levas	**144 130**	
Spannvorrichtung für Zahnriemen Hydraulik-pumpe Tensioning device for toothed belt, hydraulic pump Dispositif à serrer les courroies crantées de pompes hydrauliques Tensor de correa dentada, bomba hidráulica	**144 600**	
Ausziehwerkzeug für Rohr Puller for pipe Extracteur de tube Extractor para tubos	**150 140**	
Montagedorn für Rohr Assembly arbor for pipe Mandrin de montage pour tube Mandril de montaje para tubos	**150 150**	

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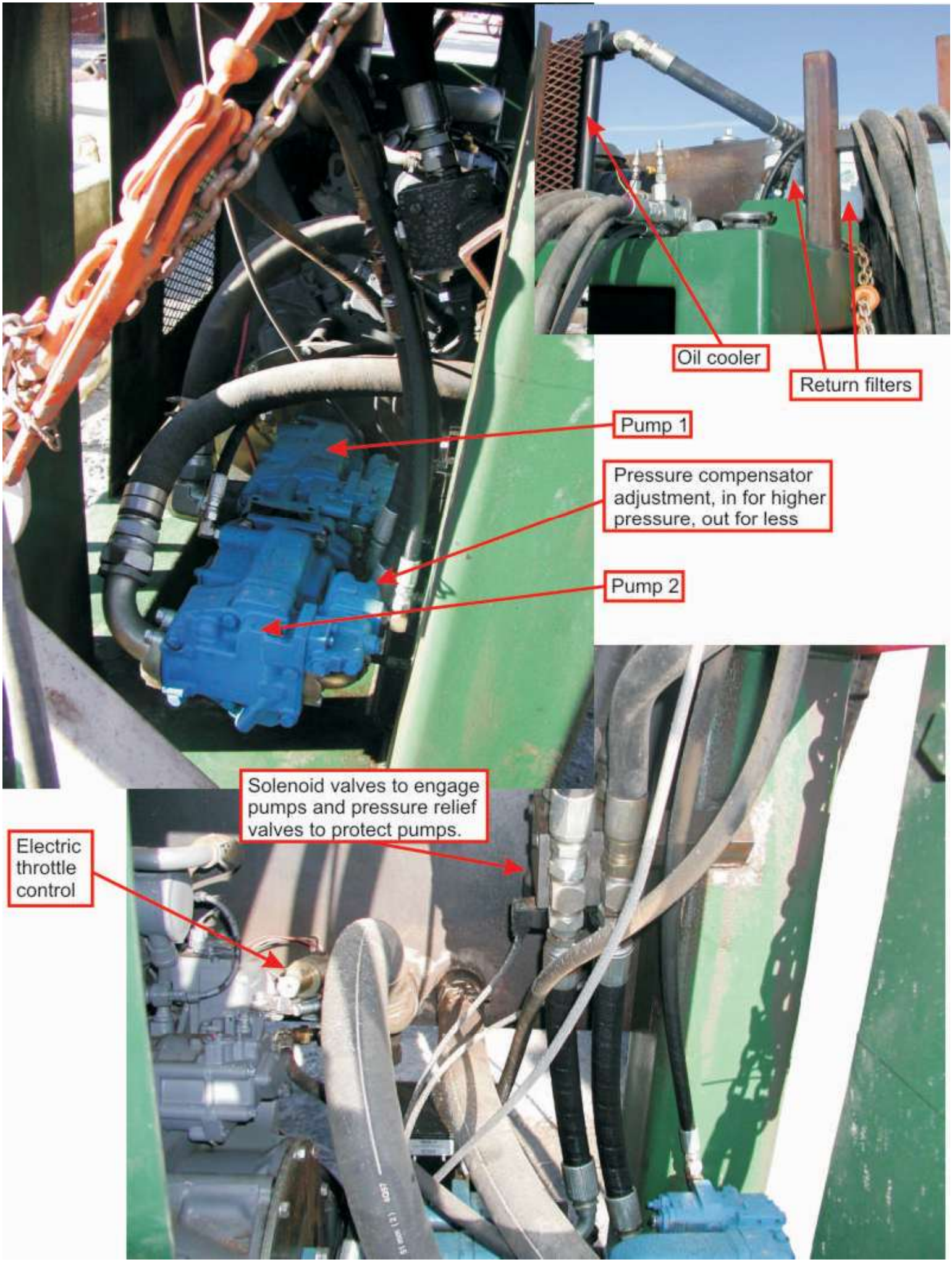
170 110	Spezialschlüssel für Öldruckgeber Special wrench for oil pressure sensor Clé spécial pour capteur de pression d'huile Llave especial para transmisores de presión de aceite
6067	Motormontagebock Engine assembly stand Chevalet de montage de moteur Caballete de montaje de motores
6067/115	Aufspannhalter Angled clamping plate Support d'ablocage Soporte de fijación


Oil cooler
Return filters
Pump 1
Pressure compensator adjustment, in for higher pressure, out for less
Pump 2
Solenoid valves to engage pumps and pressure relief valves to protect pumps.
Electric throttle control